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(I. C.)

A

CONCISE SYSTEM

OF

COMMERCIAL ARITHMETIC,

ADAPTED TO MODERN PRACTICE:

WITH

AN APPENDIX,

CONTAINING

A SERIES OF QUERIES ON BILLS AND MERCHANTS' ACCOUNTS,
AND A COURSE OF LETTERS ON BUSINESS;

ALSO,

DUODECIMALS, TIMBER-MEASURING, ARTIFICERS' COMPUTATIONS,
AND THE SQUARE AND CUBE ROOT, WITH THEIR APPLICATION.

Designed as a Text-Book for Schools;

AND PECULIARLY ADAPTED FOR PREPARING YOUTH FOR
COMMERCIAL EMPLOYMENT.

By JAMES MORRISON, ACCOUNTANT;

Author of the Elements of Book-keeping, Commercial Letter-Writer, and
Young Ladies' Guide to Figures and Accounts, &c.

A NEW EDITION, REVISED AND IMPROVED.

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PREFACE.

In a Commercial Country, such as Great Britain, the Art of Computation is indispensably necessary. It is only by the knowledge of Figures that a just calculation is made, by which the Merchant can judge with certainty when and where to embrace his opportunity of profit. Every attempt, therefore, to improve the system of Mercantile Education must be acceptable and highly deserving of the regard and attention of those who feel interested in the education of Youth.

The Author trusts, that, in the following Treatise, there will be found a degree of utility superior to what has hitherto been derived from works of this nature; as he has been employed in situations where he had the advantage of becoming acquainted with the most eligible methods of calculation, in the various departments of Commerce. The Student will find several new and concise methods of computation interspersed through the work, but particularly in the Rules of *Practice*, *Commission*, *Calculation of Interest*, *Insurance*, and *Loss and Gain*.

Though these Rules may, in the *theory* of Arithmetic, be considered as parts of the *Rule of Three*, their importance in Commerce, however, renders it necessary to treat of them under distinct heads; and to introduce such methods as Men of Business have found necessary for despatch, and whose claim to superior utility has been determined by experience. *

In composing the following work, the Author's object was to introduce only such Rules and Examples as were of practical utility. He has also endeavoured, in the plan of arrangement which he has adopted in the *Elementary Rules*, to make the learner expert in one RULE before he enters upon another; in other words, to enable him to acquire a facility in *Addition*, both of simple and compound quantities, before he proceeds to *Subtraction*, or the following rules.

In this work the Tables of WEIGHTS and MEASURES are given as an Introduction, which renders the work less complex, and affords a greater facility of reference.

In PROPORTION, the distinction of the Rule into *direct* and *inverse* is rejected, and one general Rule given for working all questions. We have also omitted such questions whose *first* or *third* terms are *unity*; because these properly belong to Multiplication or Division.

In VULGAR FRACTIONS, considerable pains have been taken to contract and simplify this abstruse part of the science, and at the same time to preserve every thing which appeared to be of real use in practice; to this branch is subjoined, as a *practical exercise*, a series of new and appropriate questions.

---

* The superiority of the Work, in adopting the most concise methods of calculation for *mercantile practice*, will appear when contrasted with those to be found in other school-books on this subject. The Text-books most in use at present are those of *Walkingame, Hutton,* Bonnycastle, Vyse, Taylor, and Joyce.

In DECIMALS, the Writer has endeavoured to avoid being too concise, by omitting the arithmetic of *repeaters*, as several modern Authors have done; thereby rendering their subsequent calculations inaccurate; or to treat the subject more fully than mercantile practice required. He has given rules for reducing *circulating decimals* to vulgar fractions, by which any question where such decimals occur may be more easily wrought than by the rules usually given in that branch of decimals.

In the Rules of INTEREST are given two very important cases, omitted in all our popular Text-books, namely, the method of computing Interest on *Debts*, when partial payments have been made: and on *Accounts Current;* though such transactions regularly occur in business.

In MARINE INSURANCES, the method of calculating the *premium;* the *amount* to be insured to cover any proposed sum; the amount of return for *convoy and arrival;* and of computing *averages*, are illustrated by practical examples.

The Rule of GAIN and LOSS has been blundered by almost every Writer on Arithmetic. Instead of only a general hint to the learner, how to solve all questions which fall under this extensive *Rule*, we have selected four *Cases*, and given *Rules* for working every question which usually occurs in mercantile affairs.

In PARTNERSHIP*, the imaginary suppositions universally given by other Writers are expunged, and the *proceeds* of the Concern divided agreeably to the terms of the Partners'

---

* "In Partnership, or Fellowship with Time," the authors alluded to, solve their questions upon the absurd principle, that the profits of a Concern increase as uniformly as the grass grows. In business, the difference of time, as it respects each partner's advances, is settled by an *Interest account*, according to a certain rate of Interest agreed on.— *Vide* pages 143. and 144. *Quest.* 5th.

Contract. The several cases and examples are drawn from real life. And in BANKRUPTCY (a rule omitted by every other writer) is shown how much any insolvent person, or company's effects will pay per pound, and the neatest method of finding how much a creditor will receive for his claim at a certain composition, or dividend per pound.

In the other Rules, several alterations from other writers have been made: these have been suggested to the Author in the course of his practice, and he hopes they will be found to be improvements.

The Work concludes with an Appendix, containing a series of QUERIES on BILLS and MERCHANTS' ACCOUNTS. These queries comprise the substance of the Mercantile law and practice, with regard to the nature and negotiation of Drafts, Promissory Notes, and Foreign Bills of Exchange; to which are subjoined, a number of Mercantile Letters on various occasions; also, DUODECIMALS, TIMBER MEASURING, ARTIFICERS' WORKS, and the extraction of the SQUARE and CUBE ROOT, with their application to several useful purposes in life.

To conclude: — The Author flatters himself that the Work will be found peculiarly useful in preparing young men for commercial situations, and, with its merits and defects, he cheerfully submits it to the decision of the candid and experienced Teacher and practical Accountant.

N. B. *As it cannot be supposed that every Teacher can enter into the views of the Author in conducting the operation of the several rules; a* KEY *is published, in which the mode of arrangement and solution of every question are given. This work it is hoped will not only lessen the labour of the Teacher, but greatly facilitate the progress and improvement of the Pupil.*

ADVERTISEMENT

TO THE

SECOND EDITION.

The following are the alterations and additions made in this impression.

The former **Tables** of Weights and Measures have been set aside, and the **New System** introduced. These Tables are deduced from the Act "for ascertaining and establishing uniformity of Weights and Measures," throughout *Great Britain* and *Ireland*, passed 17th June 1824; and Rules and Examples are annexed, for comparing the New measures with the Old standards.

In **Simple Proportion**, another **Rule** is given for stating questions, more conformably to the principles of Analogy, and the doctrine of Proportion — the usual method being now seldom used by modern Mathematicians.

Also, a **Supplement** is given, containing *Answers* to the Exercises and Questions proposed in the work, which will save the Preceptor the trouble of referring to the Key, to ascertain whether the pupil has performed his operations correctly. The Key, however, will be found useful in detecting any error which may have crept into the operation, and also in affording the pupil an idea how to set down his Accounts in a neat and distinct manner.

With these alterations and improvements the Author trusts, that the work, as a *practical Text Book*, for the use of Schools, will at least have an equal claim with any other in circulation.

London,
26th Sept. 1825.

N. B. In this third Edition the Author has carefully revised the work, and has corrected any error and supplied any omission which he discovered. J. M.

1st August, 1830.

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INTRODUCTION;

CONTAINING

The WEIGHTS and NEW MEASURES.

UNIFORMITY of Weights and Measures must greatly facilitate the operations of Trade and Commerce; and though, by the articles of the Union, in 1707, the English standards were established by law over all Great Britain; yet, the force of custom has been so strong, that in North Britain the Scotch standards have been still retained; and likewise a variety of local Weights and Measures have been used in particular counties in *England*, as well as in *Scotland*, which differ from the general standards of either.

To remedy this inconvenience, the Legislature passed an Act on the 17th June, 1824, entitled, "An Act for ascertaining and establishing uniformity of Weights and Measures." This Act is to extend to Great Britain and Ireland, and from it the following Tables have been drawn up.

I. BRITISH, or STERLING MONEY.

In Britain, as well as in all Trading Places, the Current Money, or specie, is either *gold*, *silver*, or *copper*. The division of the pound Sterling is as follows:—

The Pound (marked £.) = 20 shillings.
Shilling (— *s.*) = 12 pence.
Penny (— *d.*) = 4 farthings.
Halfpenny............ = 2 farthings.

II. STANDARD WEIGHTS.

No other weight is to be used except Troy, and Avoirdupois. The pound Troy to contain 5760 grains, and the pound Avoirdupois 7000 Troy grains.

1. TROY WEIGHT.

The Troy pound is the standard at the Mint, and for Jewellers and Apothecaries.

This weight is used also for experiments in natural philosophy and ascertaining the strength of spirits.

The Pound.......... (*lb.*) = 12 ounces, or 5760 grains.
Ounce .... (*oz.*) = 20 penny-weights, or 480 grs.
Penny-weight (*dwt.*) = 24 grains.

N. B. As the Troy dram of 60 grains, and scruple of 20 grains, are not acknowledged in the Act, the table of Apothecaries' Weight is suppressed.

NEW COINAGE.

Gold Coins.	dwts.	grs.	*Silver Coins.*	dwts.	grs.
Double sovereign, *wt*....	10	$6\frac{1}{2}$	Crown, *weight*............	18	$4\frac{4}{11}$
Sovereign..................	5	$3\frac{1}{4}$	Half-Crown..............	9	$2\frac{2}{11}$
Half sovereign...........	2	$13\frac{1}{2}$	Shilling....................	3	$15\frac{3}{11}$
Guinea....................	5	$9\frac{1}{3}$	Sixpence.................	1	$19\frac{7}{11}$

The standard gold Coin in this Kingdom contains 22 parts of pure gold, 1 of fine silver, and 1 of fine copper. A pound of standard gold is coined into 44½ guineas, and therefore the value of an ounce Troy of standard gold, at the mint price, is £3„17„10½.

A pound Troy of standard silver for Coin, contains 11 oz. 2 dwts. of pure silver, and 18 dwts. of alloy. It was formerly coined into 62 shillings; but since 1816, it is coined into 66 shillings. The current price of bullion varies like that of other commodities, according to the scarcity or demand.

2. AVOIRDUPOIS WEIGHT.

This weight is to be used for every purpose, except those mentioned under Troy weight.

The Ton (*T.*)..................... = 20 Cwt., or 2240 lbs.
Hundred weight (*cwt.*).... = 4 qrs., or 8 stones, or 112 lbs.
Quarter, or 2 stones (*qr.*) = 28 pounds.
Stone (*st.*) .... = 14 pounds.
Pound *lb*,) .... = 16 ounces, or 7000 grains Troy.
Ounce (*oz.*) .... = 16 drams, or 437½ qrs.

Note. For a Comparison of the Weights and Measures, *vide* pages 8—10.

III. STANDARD MEASURES OF LENGTH.

All measures within the United Kingdoms, whether lineal, superficial, or solid, are to be derived from, and regulated by the *Yard.*

1. CLOTH MEASURE.

Is used for all kinds of woollen, linen, and muslin cloths, wrought *silks, ribands,* tape, &c.

The Yard (*yd*)......... = 4 quarters, or 16 nails.
Quarter (*qr.*)...... = 4 nails.
Nail (*na.*) .... = $2\frac{1}{4}$ inches.

Note. The English ell is a yard and a quarter, and used chiefly in Muslin Manufactories, in rating the prices of weaving.

2. LONG, OR LINEAL MEASURE.

This measure respects length only, and is used in taking the distance from one place to another.

The Mile (*mi.*)............ = 8 furlongs, or 1760 yards.
Furlong (*fur.*)...... = 40 poles, or 220 yards.
Pole, or rod (*po.*)... = $5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet.
Fathom (*fath.*)...... = 2 yards, or 6 feet.
Yard (*yd.*)........... = 3 feet, or 36 inches.
Foot (*ft.*)............ = 12 inches.
Inch * (*in.*) .... = 12 lines, or parts.
Note. A league .... = 3 miles of sea.

3. SQUARE, OR SUPERFICIAL MEASURE.

This measure respects both length and breadth, and is understood when we enquire the extent of a field, or a floor, the size of a window, or table, &c. A superficial foot is either a square, which measures a foot in length, and a foot in breadth, or a space of equal extent in any form; for example, two feet in length, and 6 inches in breadth, is also a square foot.

The Acre † (*ac.*)............= 4 roods, or 160 po., or 4840 sq. yards.
Rood (*ro.*)..............= 40 poles, or perches, or 1210 sq. yards.
Square pole (*sq. po.*)..= $30\frac{1}{4}$ sq. yards, or $272\frac{1}{4}$ sq. feet.
Square yard (*sq. yd.*)..= 9 sq. feet, or 1296 sq. inches.
Square foot (*sq. ft.*)...= 144 square inches.

Note. In carpentry, 100 superficial feet make a square of flooring.

4. CUBIC, OR SOLID MEASURE.

This measure includes length, breadth, and thickness, or depth. It is universally used for timber, stones, masonry, and all kinds of works computed by their solid contents.

---

* The length of 3 barley-corns was formerly reckoned an inch.

† The English chain, called *Gunter's*, used in measuring land, though not mentioned in the Act, will be retained. It is 4 poles, or 22 yards, or 66 feet in length, and is divided into 100 equal parts or links, each link being $7\frac{22}{100}$ inches. The square chain is equal to 484 square yards, or one tenth of an acre.

A solid foot is either a cube, or die, measuring a foot in length, in breadth, and in thickness, or a solid of equal content.

The Cubic yard............ = 27 cubic feet.
Cubic foot............. = 1728 cubic inches.
A Load................ = { 40 cubic feet of rough, or
50 cubic feet of hewn timber.
A Ton of shipping... = 42 cubic feet.

IV. MEASURES OF CAPACITY.

The old measures, both for Liquors, and for Corn, &c. are abolished, and the new standard Imperial *Gallon* to be used both for Liquids, and Dry Goods. This Gallon contains 277.27, or 277¼ cubic inches nearly.

1. WINE AND SPIRIT MEASURE.

A Tun (*T.*).................. = 2 pipes, or 252 gals.
Pipe (*pi.*).................. = 2 hhds., or 126 gals.
Hogshead (*hhd.*)......... = 63 gallons.
Gallon (*gal.*).............. = 4 quarts, or 8 pints.
Quart (*qt.*)................. = 2 pints.
Pint (*pi.*).................. = 4 quarterns, or gills.
Half pint (*h. pt.*)......... = 2 quarterns.
Quartern *, or Gill (*qu.*)= 2 glasses of spirits.

Notes. 1. The old Wine Gallon was divided as above, and contained 231 cubic inches.

2. A Pipe, or Butt, of Malaga, is 126 gallons, as in the Table; but the Pipe of foreign Wines varies from 110 to 140 gallons.

3. A Puncheon of Spirits is 84 gallons, by the Excise; but a Cask of Rum, which contains from 90 to 120 gallons, is usually called a *Puncheon.*

2. ALE AND BEER MEASURE.

A Butt (*but.*).......... = 2 hhds. or 108 gals.
Hogshead (*hhd.*)... = 54 gallons.
Barrel (*bar.*)........ = 36 gals., or 2 kilderkins.
Kilderkin (*kil.*)..... = 2 firkins, or 18 gallons.
Firkin (*fir.*)......... = 9 gallons. †
Gallon (*gal.*)....... = 4 quarts, or 8 pints.
Quart (*qt.*).......... = 2 pints.
Pint (*pt.*)............ = 2 gills of beer.

---

* In some Counties the *quartern* is called a *noggin.*

† It is remarkable, that in almost every Book on Arithmetic, the Firkin of Ale is said to be less in London than that of Beer; though, by Act 43 *Geo.* 3. *cap.* 69., the Barrel of Beer or Ale sold by the common Brewers of Great Britain, must contain 36 Gallons, or *9 Gallons to the* Firkin.

Notes. 1. The old Ale and Beer Gallon contained 282 cubic inches; and the old Wine Gallon, 231 inches; therefore 77 Ale Gallons were equal to 94 gallons of the former measure.

2. As 63 Gallons make a Hogshead of Wine or Spirits, and 54 Gallons a Hogshead of Ale or Beer; therefore, 6 Hogsheads of Wine are equal to 7 Hogsheads of Ale by the New measures.

3. CORN, OR DRY MEASURE.

A Last (*la.*)..................... = 2 weys, or 80 bushels.
Wey, or Load, (*W.* or *lo*) = 5 quarters, or 40 bushels.
Quarter (*qr.*)................. = 8 bushels, or 32 pecks.
Bushel (*bus.*)................. = 4 pecks, or 8 gallons.
Peck (*pe.*)..................... = 2 gallons, or 8 quarts.
Gallon (*gal.*)................. = 4 quarts, or 8 pints.
Pint (*pt.*)...................... = 34⅔ cubic inches.

Notes. 1. The Gallon, here as was formerly observed, is the same as in Wine and Ale Measure, 277.27, or 277¼ cubic inches, and the new Bushel 2218.19 cubic inches.

2. The Winchester bushel, which was the former standard for England, contained 2150.42 cubic inches, and the gallon 268⅘ inches. For a comparison between the old and new measure, *vide* pages 8—10.

3. All Goods measured by this Bushel, which are not heaped, are to be stricken by a straight Roller.

4. HEAPED MEASURE.

The Bushel here is the same as in Corn Measure, and of a circular form, 19½ inches diameter. Upon this measure the goods are to be heaped in the form of a cone, at least 6 inches high, and the outside of the bushel is to be the extremity of the base; and when heaped, it contains about 2815½ cubic inches.

This measure is to be used for coals, culm, lime, fish, potatoes, or fruit, and all other goods sold by heaped measure.

A Score of coals = 21 chaldrons.
Chaldron...... = 12 sacks, or 36 bushels.
Sack............ = 3 bushels.

MEASURE OF TIME.*

TIME is a certain measure of duration, depending on the motion of the celestial bodies, which is either apparent, mean, or sidereal.

---

* The length of the year, according to the *Julian* or old style, is 365 days 6 hours. These six hours, in the space of four years, make one day, which is added to February. This year is called *Bissextile*, or leap-year; but the precise time the sun takes to go round, from one tropic to the same again, is 365 days, 5 hours, 48 minutes, 48 seconds, which is the exact length of the year, as

Apparent time is regulated by the apparent motion of the sun; *mean* or *equated time*, is the mean or average of apparent time; *sidereal time* is determined by the diurnal revolutions of the heavenly bodies.

A Julian year............... = 365 days 6 hours.
Solar year................ = 365 days, 5 hrs. 48 min. 48 sec.
Civil year................ = 365 days, or 12 calendar months.
Lunar month............ = 4 weeks, or 28 days.
Civil or natural day ... = 24 hours.
An hour.................. = 60 minutes.
A minute................ = 60 seconds.

Note. The Julian year contains 8766 hours, or 5259600 minutes, or 31557600 seconds.

The number of days in each calendar month is as follows:

January.....	31 da.	May.........	31 da.	September	30 da.
February...	28	June.........	30	October...	31
March.......	31	July..........	31	November	30
April.........	30	August......	31	December	31

In the following lines the number of days is also expressed: —

Thirty days have September,
April, June, and November:
February *twenty-eight* alone,
And all the rest have *thirty-one.*

QUARTERLY TERMS.

First Term, or Lady-day.........	25th March.
Second Term, or Midsummer ...	24th June.
Third Term, or Michaelmas......	29th September.
Fourth Term, or Christmas.....	25th December.

Note. In Scotland the 1st quarterly term is on *Candlemas*, or 2d February; 2d term, *Whitsunday*, 15th May; 3d term, *Lammas*, 1st August; and 4th term, *Martinmas*, 11th November.

---

marked out by the seasons. As that computation, therefore, exceeds the true year by 11 minutes 12 seconds, these, in 400 years, will amount to 3 days, 2 hours, 40 minutes; and the 1st January, by the calendar, should be the 4th by the seasons. To correct this, the Gregorian or new style enacts, that of every 400 years the 100th, 200th, and 300th should not be made leap, but common years; by which means the seasons and calendar are made so nearly to agree as scarcely to differ one day in 36 centuries.

The years made common, are 1700, 1800, 1900—2100, 2200, 2300—2500, &c.

As leap-year usually happens every fourth year, divide the year by 4; if nothing remain, it is leap year. Thus, 1824, 1828, 1832, &c., being divisible by 4, without a remainder, are leap-years.

MISCELLANEOUS ARTICLES.

Wool. 2 stones, or 28 lbs., make a legal todd; 15 lbs. a customary stone, or 30 lbs. a todd; 15 stones, or 8 todds, 1 pack.

Paper. 24 sheets make a quire; 20 quires, a ream; 2 reams, a bundle.

Cotton Yarn. 80 threads make a skein; 7 skeins, a hank; 18 hanks, a spyndle.

N. B. The Reel measures one yard and a half, or 54 inches in circuit.

Hay. 56 lbs. of old, or 60 lbs. of new hay, make a truss; and 36 trusses, 1 load.

N. B. 36 lbs. of straw make a truss, and 36 trusses a load.

Note. A dozen............... = 12 articles of any kind.
A long dozen......... = 13 articles.
A gross................ = 12 dozen.
A great gross......... = 12 gross, or 144 dozen.
A score................ = 20 articles of any kind.
A hundred............ = 5 score.
A long hundred....... = 6 score.
A roll.................. = 5 dozen skins of parchment.

EXPLANATION OF THE SIGNS USED IN ARITHMETIC.

$=$ the sign of equality, as 12 pence $=$ 1 shilling.
$+$ plus, the sign of addition, as $7+5=12$.
$-$ minus, the sign of subtraction, as $12-7=5$.
$\times$ the sign of multiplication, as $7\times5=35$.
$\div$ the sign of division, as $35\div7=5$; or $\frac{35}{7}=5$ also.
$: \; ::$ the sign of proportion, as $2:4::3:6$, that is, 2 is to 4, as 3 is to 6.
$\sqrt{\ }$ the sign of the square root, as $\sqrt{9}=3$.
$\sqrt{\ }^{3}$ the sign of the cube root, as $\sqrt{\ }^{3}27=3$.
And 27^2 denotes, that 27 is to be squared.
27^3 denotes, that 27 is to be cubed.

COMPARISON OF THE WEIGHTS AND NEW MEASURES.

Though no new measure is allowed to be made, but in conformity to the Imperial standard, persons may make use of those at present in their possession, provided they have the proportion they bear to the new standard marked upon them; and, therefore, it will be frequently necessary to reduce the old measures to the new Imperial standard, and the contrary.

We shall conclude this Introduction by stating a comparison between *Troy* and *Avoirdupois Weights*, and also between the old and new standards for *Liquid* and *Dry Measures;* after which, we shall lay down rules for reducing the one to the other, and illustrate them by examples.

I. Comparison of the Weights.

As the pound Troy contains 5760 grains, and the pound Avoirdupois 7000 grains; if these numbers be divided by 40, their common measure, it will be seen that the proportion will be as follows:—

144 lbs. Avoirdupois ...... = 175 lbs. Troy.
1 pound Troy........... = 13 oz. 2½ drams Avoirdupois.
1 pound Avoirdupois ... = 1 lb. 2 oz. 11 dwts. 16 grs. Troy.
1 ounce Avoirdupois ... = 437½ grs., or 18 dwts. 5½ grs. Troy.
192 oz. Avoirdupois .... = 175 oz. Troy.

Hence, the pound Avoirdupois is heavier than the pound Troy, in the proportion of 175 to 144; but, the ounce Avoirdupois is lighter than the ounce Troy by 42½ grains, or in the proportion of 175 to 192.

To reduce Troy Weight to Avoirdupois, and the contrary.

Rule I. *Multiply by* 144, *and divide by* 175; *the quotient gives Avoirdupois Weight.*

II. *Multiply by* 175, *and divide by* 144; *the quotient gives Troy Weight.*

Ex. 1st, How many lbs. Avoirdupois in 1225 lbs. Troy?

$$\frac{1225 \times 144}{175} = 1008 \text{ lbs. Avoir.}$$

Answer.

Ex. 2d, How many lbs. Troy in 1008 lbs. Avoirdupois?

$$\frac{1008 \times 175}{144} = 1225 \text{ lbs. Troy.}$$

Answer

II. The Wine Gallon, compared with the New Imperial Gallon.

As the New Imperial Gallon contains 277¼ cubic inches, and the Old Wine Gallon 231 inches; the Imperial Gallon is to the Wine Gallon, as 1109 to 924; or nearly as 6 is to 5; that is, 5 new *gallons are equal to 6* gallons of the old measure.

To Reduce the Old Wine or Spirit Gallon to the New, and the Contrary.

Rule I. *Multiply by* 924, *and divide by* 1109; *the quotient gives the Imperial gallons — Or, deduct* $\frac{1}{6}$*th part.*

II. *Multiply by* 1109, *and divide by* 924; *the quotient gives the old wine gallons — Or, add* $\frac{1}{5}$*th part.*

Ex. 1st, How many Imperial gallons in a hogshead of spirits, old measure?

$$\frac{63 \times 924}{1109} = 52\tfrac{1}{2} \text{ gallons, New Measure.}$$

Or $\frac{1}{6}$ | 63 gallons = 1 hogshead.
| $10\frac{1}{2}$ deduct.

Anr. $52\frac{1}{2}$ New gallons.

Ex. 2d, How many gallons old measure in a pipe of Madeira qt. 110 Imperial gallons?

$$\frac{110 \times 1109}{924} = 132 \text{ gallons, Old Measure.}$$

Or $\frac{1}{5}$ | 110 Imperial gallons.
| 22 add.

Anr. 132 gallons Old measure.

III. As the Old Ale or Beer Gallon contains 282, and the New Imperial Gallon, $277\frac{1}{4}$ cubic inches; the proportion is as 1128 to 1109, or nearly as 60 to 59; that is, 59 Old Ale or Beer Gallons are equal to 60 New Gallons.

To Reduce the Old Ale or Beer Gallon to the New, and the Contrary.

Rule I. *Multiply by* 1128, *and divide by* 1109; *the quotient gives the new gallons — Or, add* $\frac{1}{60}$*th part.*

II. *Multiply by* 1109, *and divide by* 1128; *the quotient gives the gallons, old measure — Or, deduct* $\frac{1}{59}$*th part.*

Ex. 1st, How many Imperial gallons in 10 Butts of Beer of Old Measure?

$$\frac{1080 \times 1128}{1109} = 1098 \text{ gallons, New Measure.}$$

Or $\frac{1}{60}$ | 1080 gallons = 10 butts.
| 18 add.

Anr. 1098 gallons, as before.

Ex. 2d, How many gallons of Ale, Old Measure, in 1098 of New?

$$\frac{1098 \times 1109}{1129} = 1080 \text{ gallons, Old Measure.}$$

Or $\frac{1}{59}$ | 1098 new gallons.
| 18 deduct.

Anr. 1080 gallons, as before.

IV. As the Imperial standard Bushel contains 2218 cubic inches, and the Winchester Bushel 2150; the proportion of the former to the latter is as 1109 to 1075, or nearly as 33 to 32; that is, 32 pecks, bushels, or quarters of New measure, are equal to 33 of Winchester measure.

TO REDUCE WINCHESTER MEASURE TO THE IMPERIAL STANDARD, AND THE CONTRARY.

RULE I. *Multiply by* 1075, *and divide by* 1109; *the quotient gives the standard measure — Or, deduct $\frac{1}{33}$d part.*

II. *Multiply by* 1109, *and divide by* 1075; *the quotient gives the Winchester measure — Or add $\frac{1}{32}$d part.**

Ex. 1st, How many Imperial Bushels in 1320 Winchester Bushels?

$$\frac{1320 \times 1075}{1109} = 1280 \text{ Bushels, New Measure.}$$

Or $\frac{1}{33}$ | 1320 Winch. Bushels.
40 deduct.

Ansr. 1280 Imperial Bushels.

Ex. 2d, How many Winchester Bushels in 1280 Imperial Bushels?

$$\frac{1280 \times 1109}{1075} = 1320 \text{ Bushels Old Measure.}$$

Or $\frac{1}{32}$ | 1280 New Bushels.
40 add.

Ansr. 1320 Bushels.

* That is, a *peck* to the quarter.

QUESTIONS FOR PRACTICE, IN *NEW WEIGHTS AND MEASURES.*†

1. How many lbs. Troy weight in 1080 lbs. Avoirdupois? *Answer* 1312 lbs. 6 oz. Troy.
2. How many lbs. Avoirdupois in 1050 lbs. Troy? *Answer*, 864 lbs.
3. How many Imperial bushels in 2218 Winchester bushels? *Answer*, 2150 bushels.
4. How many Winchester bushels in 268¾ quarters new measure? *Answer*, 2218 bushels.
5. How many new gallons are equal to a Tun of the old measure? *Answer*, 210 gallons nearly.
6. How many new gallons are equal to a Butt of Beer, old measure? *Answer*, 109$\frac{17}{20}$ gallons.
7. How many quarters Barley, of new measure, are equal to 2160 bushels, Winchester measure? *Answer*, 261 qrs. 5¾ bushels.
8. If Barley cost 5/ ℘ new standard Bushel, how much will 84½ quarters of Winchester measure come to? *Answer*, £164„0„10½.

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† A solution of these questions is given at the end of the Second *Edition of* the Key.

9. A Merchant buys 288 lbs. Silk, @ 37/6 ⅌ lb. Avoirdupois, and sold it again at the same price ⅌ lb. Troy weight: How much did he gain? *Answer*, £116,5,0.

10. A Maltster sold Malt by the Winchester bushel for the same price which it cost him by the Imperial measure: How much ⅌ Cent. did he gain? *Answer*, 3⅛ ⅌ Cent.

11. A. asks for his Wheat 70/. ⅌ quarter Winchester measure; B. offers him that price by the Imperial standard. Required how much lower the offer was than the price asked. *Answer*, 2/1¾ ⅌ qr. less.

12. A Spirit-Dealer buys by the new measure, and sells at the same price by the old: How much does he gain on every £100 laid out? *Answer*, £20.

13. A Liquor-Merchant bought a hogshead of Whisky, @ 11/8 a gallon, old measure; but, by the reduction of the duty, he could obtain no more than that price by the new measure: How much will he lose, and how much ⅌ Cent? *Answer*, He loses £6,2,6, or 16⅔ ⅌ Cent.

14. A Farmer agrees to sell his Oats by the Imperial bushel, provided he gets equal to 26/8 ⅌ Winchester quarter: How much is that? *Answer*, 27/6 ⅌ quarter.

15. If Oats be bought @ 27/6 ⅌ Winchester quarter, and sold at 3/6 ⅌ standard bushel: How much is gained or lost on 3327 quarters? *Answer*, Loss £59,12,6.

16. A Brandy-Merchant imports Cognac at 14/7 ⅌ gallon, old measure (including duties, &c.): How must he sell it by the New gallon, to gain 12½ ⅌ Cent.? *Answer*, 19/8¼ ⅌ gallon.

17. A Miller contracted with a Farmer for 108 quarters Wheat, Winchester measure: How many Imperial bushels will be necessary to fulfil the order? *Answer*, 837½ bushels.

18. A Corn-Factor bought a cargo of 554½ quarters Barley, @ 41/8 Winchester measure; he sold the whole at 5/10 ⅌ standard bushel. Required his gain or loss, and how much ⅌ Cent. *Answer*, Gain £98,19,2; and 8$\frac{628}{1109}$ ⅌ Cent.

19. A Dealer in Grain contracted for Wheat at 69/4 ⅌ quarter; Barley at 40/8; Oats at 26/8; Rye at 42/8; Beans at 44/; and Peas at 45/ ⅌ qr. Winchester measure. Required what prices by the new standard are equivalent to the above? *Answer*, Wheat 71/6; Barley 41/11¼; Oats 27/6; Rye 44/; Beans 45/4½; Peas 49/6.

20. A Wine-Merchant imports Wines at £57,10,0 ⅌ pipe of 138 gallons, old measure: what does it cost him ⅌ gallon, new measure? and at what can he retail it ⅌ dozen, to gain 25 ⅌ Cent., allowing 5 bottles to the gallon? *Answer*, 10/ ⅌ gallon, and 30/ ⅌ dozen.

TABLES OF COMPARISON.

I. Equalising the prices of Corn with the *New Standard Bushel.*

New bush.	Equal to	Old bushel.	New bush.	Equal to	Old bushel.	New bush.	Equal to	Old bush.	New bush.	Equal to	Old bushel.
1/6	......	1/5¼	3/9	......	3/7½	6/.	......	5/9¾	8/3	......	8/.
1/9	......	1/8¼	4/.	......	3/10¼	6/3	......	6/0½	8/6	......	8/2¾
2/.	......	1/11¼	4/3	......	4/1¼	6/6	......	6/3½	8/9	......	8/5¾
2/3	......	2/2	4/6	......	4/4¼	6/9	......	6/6½	9/.	......	8/8½
2/6	......	2/5	4/9	......	4/7¼	7/6	......	6/9¼	9/3	......	8/11½
2/9	......	2/7¾	5/.	......	4/10	7/3	......	7/0¼	9/6	......	9/2½
3/.	......	2/10¾	5/3	......	5/1	7/6	......	7/3¼	9/9	......	9/5¼
3/3	......	3/1¼	5/6	......	5/3¾	7/9	......	7/6	10/.	......	9/8¼
3/6	......	3/4½	5/9	......	5/6¾	8/.	......	7/9	10/3	......	9/11

II. Equalising the prices of Spirituous Liquors with the *New Gallon.*

New gal.	Equal to	Old gal.	New gal.	Equal to	Old gallon.	New gal.	Equal to	Old gallon.	New gal.	Equal to	Old gallon.
2/6	......	2/1	9/6	......	7/11	16/6	......	13/9	23/6	......	19/7
3/.	......	2/6	10/.	......	8/4	17/.	......	14/2	24/.	......	20/.
3/6	......	2/11	10/6	......	8/9	17/6	......	14/7	24/6	......	20/5
4/.	......	3/4	11/.	......	9/2	18/.	......	15/.	25/.	......	20/10
4/6	......	3/9	11/6	......	9/7	18/6	......	15/5	25/6	......	21/3
5/.	......	4/2	12/.	......	10/.	19/.	......	15/10	26/.	......	21/8
5/6	......	4/7	12/6	......	10/5	19/6	......	16/3	26/6	......	22/1
6/.	......	5/.	13/.	......	10/10	20/.	......	16/8	27/.	......	22/6
6/6	......	5/5	13/6	......	11/3	20/6	......	17/1	27/6	......	22/11
7/.	......	5/10	14/.	......	11/8	21/.	......	17/6	28/.	......	23/4
7/6	......	6/3	14/6	... ..	12/1	21/6	......	17/11	28/6	......	23/9
8/.	......	6/8	15/.	......	12/6	22/.	......	18/4	29/.	......	24/2
8/6	......	7/1	15/6	......	12/11	22/6	......	18/9	29/6	......	24/7
9/.	......	7/6	16/.	......	13/4	23/.	......	19/2	30/.	......	25/.

A
CONCISE SYSTEM
OF
COMMERCIAL ARITHMETIC.

DEFINITIONS.

ARITHMETIC, as a *Science*, explains the properties of numbers; and, as an *Art*, teaches the method of computing by them.

1. An *Integer* is a whole number, as distinguished from a fraction; as, 1, 5, 30, &c.

2. A *Fraction* is a part or division of an unit or integer; as, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{7}{12}$, &c.

3. A *Mixed Number* is a whole number with a fraction annexed; as, $2\frac{1}{4}$, $5\frac{1}{2}$, $30\frac{3}{4}$, &c.

4. A *Prime Number* is a number which can be measured only by its self or by unity; as, 2, 3, 5, 7, 11, 13, &c.

5. A *Composite Number* is a number, produced by multiplying two or more numbers together, as, 3×12, or 4×9, or 6×6, are all component parts of 36: or $5 \times 5 \times 5 = 125$.

6. A *Common Measure* is a number, which can divide two or more numbers without a remainder; as, 4 measures 12 and 16.

7. An *Aliquot Part* is such a part as is contained in an integer an exact number of times; thus, 2, 4, 5, and 10, are aliquot parts of 20.

NOTATION AND NUMERATION.

NOTATION teaches us to express numbers by figures; and NUMERATION teaches to read the value of numbers expressed by figures.

All numbers are represented by the ten following characters; viz. 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. The nine first are called significant figures, or digits, to distinguish them from the cipher, which, of itself, has no value, and they represent units, tens, hundreds, &c. according as they stand in the following

NUMERATION TABLE.

QUADRILLIONS.	Hundred thousand trillions.	Ten thousand trillions.	Thousand trillions.	Hundred trillions.	Ten trillions.	TRILLIONS.	Hundred thousand billions.	Ten thousand billions.	Thousand billions.	Hundred billions.	Ten billions.	BILLIONS.	Hundred thousand millions.	Ten thousand millions.	Thousand millions.	Hundred millions.	Ten millions.	MILLIONS.	Hundred thousands.	Ten thousands.	Thousands.	Hundreds.	Tens.	Units.
5.	4	3	2,	1	0	9.	8	7	6,	5	4	3.	2	1	0,	9	8	7.	6	5	4,	3	2	1

The first six figures from the right are called the *unit* period; the next six the *million* period; after which the *billion, trillion, quadrillion, quintillion, sextillion, octillion,* and *nonillion* periods follow in their order.

CASE I. TO READ ANY NUMBER.

RULE. *Beginning at the left hand, read in each period as many hundreds, tens, and units, as the figures in those places express; adding the name* THOUSANDS, *after reading the three left-hand figures, and naming the* PERIOD *after the three right-hand figures of any period.*

EXAMPLE.

Express in words 4100078151049067O9.

Billions.	Millions.	Thousands.	Hundreds.	Tens.	Units.
410007	815104	906	7	0	9

The above number is read thus: *Four hundred and ten thousand and seven billions, eight hundred and fifteen thousand one hundred and four millions, nine hundred and six thousand, seven hundred and nine.*

REMARKS. 1st, It is proper to divide any long number, before we reckon it, into periods and half-periods, by different marks. We then begin at the left hand, and read the figures in their order, with the names of their places, from the table.

2d, In numbers consisting of more than one figure, the value of each figure is known by the place in which it stands: thus, a figure *in the place of units* signifies so many ones, having only its simple

EXERCISES.

Express in words the following numbers:—

1. 73,703
2. 730,7300
3. 46050
4. 586041
5. 6907039
6. 70807503
7. 87060042
8. 19175407
9. 365007300
10. 4908443001
11. 61230506078
12. 987654321090
13. 1200300400500
14. 8195000007001
15. 500705060805003
16. 9208309410379999

CASE II. TO EXPRESS NUMBERS BY FIGURES.

RULE. *Beginning at the left hand, and writing towards the right, set down the figures that correspond to the given words, each in its proper place, and supply vacancies with ciphers.*

EXAMPLES.

1. Express in figures, three hundred and twenty-five. Ans. 325
2. ——————— Four thousand and fifty.................. 4050
3. ——————— Sixty-eight thousand nine. 68009
4. ——————— Seven hundred and sixty thousand 760000
5. ——————— Eighty-seven millions and seven. 87000007
6. ——————— Nine hundred million, nine hundred thousand and ninety. 900900090

EXERCISES.

1. Wales contains six hundred and eleven thousand, seven hundred and eighty-eight inhabitants.
2. England, nine millions, five hundred and thirty-eight thousand, eight hundred and twenty-seven.
3. Scotland, one million, eight hundred and five thousand, six hundred and eighty-eight.
4. Ireland, about four millions and a half.
5. Great Britain and Ireland contain sixteen millions, four hundred and fifty-six thousand, three hundred and three: Express the number of inhabitants in each of the above places in figures.

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value; a figure in the second place, so many tens; in the third place, so many hundreds, or, which is the same, a hundred times its simple value, or ten times the value it would have, if it were in the place of tens.

3d, It appears, therefore, that all numbers increase in value from right to left in a tenfold proportion, and decrease from left to right in the same proportion.

4th, Though the cipher of itself, or on the left of any number, be of no value, yet when placed on the right of any of the other figures, it increases their value ten times. Thus, 3 signifies three; but 30 signifies three tens, or thirty; and 300 signifies thirty tens, or three hundred, and so on.

6. How is the population of France expressed in figures, which is said to be twenty-seven millions, two hundred and sixty-seven thousand, one hundred and forty-eight?
7. Required to express in figures the national debt, which, in guineas, amounts to seven hundred and eighty millions, nine hundred and fifty-two thousand, three hundred and eighty-one; and in shillings, to sixteen thousand four hundred millions.
8. The value of the whole property in Britain is estimated, at Two thousand, seven hundred, and thirty-six millions, six hundred and forty thousand pounds sterling: express this sum by figures.

Of the ROMAN NOTATION.

The Romans made use of seven capital letters to express numbers,
These numbers are: I. V. X. L. C. D. M.
Their value is 1. 5. 10. 50. 100. 500. 1000.

All other numbers are expressed by two or more of those letters, joined or repeated till the sum of the whole make up the proposed number, the characters of the greatest value being set to the left; thus VI, is 6; VII, 7; VIII, 8; and MDCCCXXX, 1830.

Sometimes a less character is put to the left of a greater, and then denotes their difference, as IV, 4; IX, 9; XL, 40; XC, 90; CD, 400. Also Iↄ stands for D, or 500; and CIↄ for M, or 1000, Every C and ↄ annexed on each side increases the value ten times; thus CCIↄↄ is 10,000. A bar or stroke over a letter increases the value 1000 times; $\overline{\text{X}}$ is 10,000, and $\overline{\text{C}}$, 100,000, &c. This notation is frequently used for the dates, numbering the chapters or sections of books, &c.

REMARKS. As very high numbers are somewhat difficult to apprehend, it may not be amiss to illustrate, by a few examples, the value of words million, billion, trillion, and quadrillion.

Suppose that a person employed in telling money, reckons a hundred pieces in a minute, and continues to do so twelve hours each day, he will take fourteen days to reckon a *million*. A thousand men would take 38 years to reckon a *billion*.

If we suppose the whole inhabitants of England and Wales to have been constantly employed in counting money since the birth of our Saviour, they could not as yet have reckoned a *trillion*.

Though we admit the earth, from the creation, to have been as populous as it is at present, and the whole human race to have been counting money without intermission, they could scarcely, as yet, have reckoned the five-hundredth part of a *quadrillion* of pieces.

QUERIES.

1. What is Arithmetic?
2. Is Arithmetic both a science and an art?
3. What is an integer?
4. What is a fraction?
5. What is a mixed number?
6. What is a prime number?
7. What is a composite number?
8. What is a common measure?
9. What is an aliquot part?
10. What do notation and numeration teach?
11. What does a *figure* in the *third place* of the table stand for?
12. What does a *figure* in the *fourth* and *seventh* place stand for?
13. What does a *figure* in the *ninth* and *twelfth* place stand for?
14. By what characters are all numbers represented?

ADDITION.

Addition is that operation by which we find the sum of two or more given numbers.

Case I. To add Integers.

Rule 1st, *Write the numbers under each other, units under units, tens under tens, and so on, and draw a line under them.*

2d, *Add the column of units, find the tens in it, set down the remainder below the column; if nothing remain, put down a cipher; and for every ten, carry one to the next column.*

3d, *Proceed thus, adding what you carry to every column till the last, under which write the whole sum.*

To prove Addition.

Method I. *Repeat the summation, beginning at the top of the columns.*

II. *Cut the columns by cross lines, at several places, and add these separately; then add the sums together.*

EXAMPLES.

Add the following numbers: —

1…	1324	2…	2548	3…	81865	4…	98765
	268		2694		15476		673254
	143		345		37238		87683
	415		1532		18614		25432
	576		184		9876		167673
	134		3267		4567		92346
	902		1420		985		36523
	2762		11990		168621		1181676

EXERCISES.

Pounds.	Guineas.	Yards.	Ells.
1... 876	2... 987	3... 9876	4... 1234
765	876	8765	2345
654	765	7654	3456
543	654	6543	4567
432	543	5432	5678
321	432	4321	6789

Tons.	Cwts.	Stones.	Lbs.
5... 1473	6... 5432	7... 9876	8... 163427
637	5432	9876	21532
1046	5432	9876	4678
964	5432	9876	936
182	5432	9876	1394
3728	5432	9876	187637
351	5432	9876	1845
859	5432	9876	67690
270	5432	9876	10809
1035	5432	9876	7163

Miles.	Acres.	Gallons.	Bushels.
9... 9132	10... 3205	11... 7300	12... 98
4280	183	6501	789
534	5697	1369	3540
1809	748	780	6431
746	943	1809	87654
2173	7262	906	9780
7531	6421	1234	6053
365	150	1495	8106
1260	1779	146	6720
432	898	2709	1108
657	5032	573	987
3243	4610	980	706
730	876	367	542
1425	678	210	450
1950	432	182	179

ADDITIONAL EXERCISES.

1. Add 531, 84, 1176, 19, 1860, 365, 91, and 910 together.
2. Add together 645, 198, 10950, 78, 30901, 89, 1234, and 1560.
3. *What is the* sum of 81, 1160, 801, 45, 198, 1010, 765, and 95 ?

4. Find the sum of 6290, 764, 613, 4731, 5214, 289, 3102, and 41.

5. Required the sum of 92, 853, 7654, 65432, 543210, 4321098, 321976, 2109, 1098, 182.

6. How much is the sum of 10467530, 37604, 6325493, 41320, 856758, 459, 2940275, 365, 10049421, 1673, 98, 497324, 7405, 32040076?

¶ 7. Add together nine hundred and nine, nine thousand and ninety, ninety thousand and nine, and eleven hundred and eleven.

8. How much is the sum of the five following numbers: Six hundred and sixty thousand, six hundred and sixty-six thousand, six hundred and sixty-six; fifty-five thousand five hundred and five, and three hundred thousand and thirty-three?

9. What is the sum of eleven thousand, eleven hundred, and eleven, added to seventeen hundred and seven?

10. If two thousand five hundred, ten hundred and fifty, seven hundred and thirty, seven thousand three hundred, and eighteen hundred and seventeen be added; what is the sum?

QUESTIONS FOR PRACTICE.

1. Required the number of inhabitants in Yorkshire, the population of which is estimated as follows: East Riding, 167353; North Riding, 152445; and West Riding, 653315?

2. The population of Wales is 611788, of England 9538827, of Scotland 1805688, and Ireland is estimated at four millions and a half: how many inhabitants are there in Great Britain and Ireland?

3. How many days are there in the first six calendar months of the year; and also, how many days in the six last months?

4. A person has in cash £150; a house, value £1050; a farm worth £2500; in goods £976; and debts owing him to the amount of £679. Required the amount of his effects?

5. A merchant owes to A. £125, B. £236, C. £109, D. £83, E. £105, F. £219, G. £401, and to H. 20 guineas, Required the amount of his debts.

6. The produce of a certain farm last year was as follows: — 199 quarters wheat, 220 do. barley, 168 do. oats, and 216 qrs. pease. Required how many quarters of grain the farm produced.

7. A wine-merchant imports from Lisbon ten pipes port wine; No. 1. containing 137 gallons; No. 2. 140 gall.; No. 3. 139; No. 4. 136; No. 5. 141; No. 6. 140; No. 7. 138; No. 8. 140; No. 9. 118; and No. 10. 139 galls.: how many gallons must he pay duty for?

8. The building of St. Paul's Cathedral, London, cost £800000; the Royal Exchange, £80000; the Mansion-house, £40000; Blackfriars Bridge, £152840; Westminster-bridge, £389000; and the Monument £13000. Required the expense of these buildings.

9. Required the age of the world at the time of the flood, from the Vth chapter of Genesis, and the 6th verse of the VIIth chapter; also, the length of time from the flood till the call of Abraham, from the tenth and following verses of the XIth chapter, and 1st verse of the XVIIth chapter.

10. The amount of taxes imposed each year, for paying the interest, &c. of the loans made during the French war till the peace of Amiens, was as follows: in 1793, £190312; in 1794, £606878; in 1795, £958481; in 1796, £1425951; in 1797, £2565301; in 1798, £950150; in 1799, £837352; in 1800, £884420; in 1801, £1364654; in 1802, £1311580. Required the sum of these taxes.

CASE II. TO ADD COMPOUND NUMBERS.

RULE 1st. *Write numbers of the same name under each other; as pence under pence, shillings under shillings, and pounds under pounds.*

2d, *Add the figures of the lowest denomination, and find how many of the next highest their sum contains.*

3d, *Set down the remainder, and carry one for each of the higher denomination to the next column.*

4th, *Proceed in this manner to carry one for each of the next higher denominations, till the last, at which carry by ten, as in Addition of whole numbers.*

Note. The method of proof is the same as in CASE I.

REMARKS. The reason why we carry 1 for every 10, in adding integers, is, because numbers increase in a tenfold proportion from right to left, and therefore 10 in any column is equal to 1 in the next column towards the left hand.

As no rule of arithmetic occurs in business more frequently than Addition, the learner should practise it till he can add with great accuracy and facility. He should at first add his *exercises* deliberately, *figure* by *figure*, and repeat the same column again and again, till he can add two or more figures at a glance. He should add without *naming* the figures, considering only the sums as he runs up and down the columns. His exercises at first should be short, and be gradually lengthened, as he becomes more expert. When the account is long, it is proper to mark down the sum of each column on a separate piece of paper, the figure to be carried to the next column. This, in case of interruption or mistake, prevents the necessity of beginning again.

The two following hints to the learner may be useful:—1st. If he can readily add any two figures, he will soon add in his mind a figure with equal ease; it is only to add the amount accordingly: thus, because 9 and 4 are 13, 29 and 4 are 33; or because 8 and 7 are 15, 18 and 7 are 25, and so on, 2d, After some practice the learner ought to acquire the habit of adding two or more figures at a glance. This is particularly useful, when two figures which amount to 10 stand together in a column; as, 6 and 4, 7 and 3, 8 and 2, 5 and 5, and 9 and 1, &c

PENCE TABLE.

Pence.	Pence.	Pence.	Pence.
15...=...1/3	48...=...4/.	84...=...7/.	120...=...10/.
20...=.. 1/8	50...=...4/2	90...=...7/6	130...=...10/10
24...=...2/.	60...=...5/.	96...=...8/.	132...=...11/.
30...=...2/6	70...=...5/10	100...=...8/4	140...=...11/8
36...=...3/.	72...=...6/.	108...=...9/.	144...=...12/.
40...=...3/4	80...=...6/8	110...=...9/2	150...=...12/6

EXAMPLES.

£60„10„ 6	£621„17„ 7½	£321„10„11
75„15„ 9	78„14„ 5¼	432„14„10
83„11„ 8	825„13„ 4¾	543„ 5„ 9
73„15„ 7	36„11„ 9½	654„16„ 8
56„10„ 5	410„12„ 6¼	765„ 7„ 6
88„ 7„ 3	98„10„ 4¾	876„18„ 4
£438„11„ 2	£2072„ 0„ 2	£3594„14„ 0

EXERCISES.

STERLING MONEY.

Borrowed from sundries.	Paid to sundries.	Lent to sundries.
£784„ 7„ 3½	£397„11„ 8¾	£1105„14„10
513„10„ 9	189„ 9„11¼	1260„ 7„ 9
647„13„ 4¾	516„17„ 6	817„11„11
568„ 6„ 8	78„ 8„ 4½	1045„ 7„ 7
625„14„10½	115„10„ 6	670„13„ 4
187„11„ 5	67„12„10½	368„ 9„10
196„ 9„11¼	120„ 6„ 8	730„ 7„ 3
320„ 8„ 7	67„11„ 3¼	1327„10„ 9
118„15„10½	98„17„ 5	981„11„ 8

Received from sundries.	Owing by sundries.	Owing to sundries.
£132„12„ 5	£321„19„11	£754„14„ 6
295„16„ 8	432„ 9„ 5½	168„ 9„ 8
118„ 8„ 4	543„14„ 7	95„ 6„10
36„11„ 5	634„10„ 9¼	423„13„ 4
379„ 7„11	765„ 6„ 4	320„ 5„ 9
116„14„ 6	876„11„10¾	1195„17„ 6
238„ 9„ 8	864„13„ 4	468„ 8„11
53„16„ 7	531„ 9„11½	324„10„ 3
320„ 7„ 4	167„ 7„ 6	286„12„ 6
254„10„ 3	219„11„ 8¼	572„ 9„10
125„14„ 9	176„ 8„10	198„ 7„ 5
110„ 7„ 6	98„17„ 3½	87„11„ 8

TROY WEIGHT.

Oz. dwt. grs.	lbs. oz. dwt. grs.	lbs. oz. dwt.
11„19„20	198„10„15„20	112„ 7„16
10„10„15	264„11„ 8„12	98„10„10
9„ 7„21	370„ 9„19„15	67„ 9„15
8„15„12	168„ 8„10„ 9	76„ 8„ 9
7„ 9„19	472„ 7„ 7„12	35„ 4„12
6„11„21	118„10„15„ 6	18„ 3„13
5„13„23	112„11„12„18	9„ 6„10
4„10„10	87„ 6„10„12	10„ 5„ 9
3„18„19	65„10„ 7„14	15„11„10
2„12„14	50„ 9„10„10	6„ 8„ 7

Open accounts.	Accepted bills.	Notes payable.
£685„10„ 6	£1950„17„ 6	£3159„11„ 9
810„ 4„ 3	1180„ 4„10	1290„ 6„ 8
118„12„ 2	943„11„ 4	3562„14„10
1195„15„11	3210„10„ 7	1806„17„11
325„ 6„ 8	1656„ 9„ 3	324„10„ 9
1806„11„ 5	869„ 5„10	760„12„ 6
541„ 7„ 6	1321„12„11	1548„ 5„ 9
1968„11„10	5740„18„10	376„11„ 8
76„ 5„ 6	915„ 5„ 9	1980„ 6„10
180„ 8„10	1808„10„ 8	2310„10„ 6
324„13„ 4	3216„12„ 4	4967„11„ 1
1868„ 4„ 7	1684„ 9„ 5	673„ 8„ 4
716„ 6„ 8	3460„13„ 6	3685„16„ 8
2680„15„ 1	1010„11„10	1760„ 5„10
763„10„ 6	1532„ 5„ 4	4981„10„ 5
3685„11„ 8	4199„10„ 3	3276„ 3„ 7
320„18„ 4	3650„17„ 2	1180„10„ 9
1516„ 9„10	878„ 8„11	932„ 4„ 8

AVOIRDUPOIS WEIGHT.

Lbs. oz. drs.	stones. lbs.	Cwt. qr. lb.	tons. cwt. qr.
25„15„15	36„13	195„ 3„27	140„19„ 3
17„10„14	25„10	176„ 1„14	89„17„ 2
36„12„10	19„ 7	154„ 2„10	48„14„ 0
39„14„ 9	14„12	138„ 0„19	59„16„ 1
24„ 9„ 4	12„10	110„ 1„21	34„12„ 3
15„11„ 7	10„ 8	98„ 3„16	67„ 9„ 2
13„10„ 5	9„11	87„ 1„18	43„10„ 3
10„12„11	8„10	76„ 0„ 9	26„18„ 1
26„ 7„ 9	7„13	65„ 2„12	15„13„ 0
18„14„ 6	5„ 6	14„ 1„ 4	8„ 9„ 2

The following cargo of sugars was sold in lots as under: required the number of casks, the whole weight, and the amount of the sales.

Casks.	Cwt. qr. lb.		£
60	799„1„11	sold for	2987„12„11
40	500„1„ 4	....	2001„ 2„10
25	348„0„24	....	1323„ 4„ 3
16	214„0„18	....	876„13„ 4
15	200„3„21	....	779„ 9„ 8
16	212„0„ 4	....	842„16„ 5
10	147„2„10	....	560„ 7„ 9
12	149„1„13	....	564„10„ 7
10	146„1„11	....	523„ 3„10
12	170„2„20	....	616„12„ 1
15	208„0„ 6	....	850„ 8„ 4
20	284„3„14	....	1109„16„11
10	150„1„17	....	620„ 5„ 6
15	203„2„10	....	865„10„ 9
12	170„1„19	....	612„19„ 4
12	168„2„27	....	600„ 4„10
10	144„2„ 5	....	559„18„ 8
8	117„1„16	....	461„ 6„ 7
6	86„3„12	....	325„10„ 3
5	67„1„ 9	....	264„ 8„ 4
		£	amount.

CLOTH MEASURE.

Yds. qr. na.	Eng.ells qr. na. in.	Yds. qr. na.
94 „ 3 „ 2	160 „ 4 „ 3 „ 1½	101 „ 1 „ 3
78 „ 2 „ 3	156 „ 3 „ 1 „ 2	85 „ 2 „ 1
69 „ 0 „ 1	143 „ 1 „ 2 „ 1¾	78 „ 0 „ 2
31 „ 3 „ 2	132 „ 0 „ 3 „ 0	67 „ 3 „ 0
56 „ 2 „ 1	121 „ 2 „ 0 „ 2	56 „ 1 „ 2
73 „ 2 „ 0	109 „ 1 „ 2 „ 1¼	45 „ 2 „ 3
82 „ 1 „ 2	98 „ 3 „ 0 „ 0	34 „ 3 „ 1
90 „ 1 „ 3	76 „ 0 „ 1 „ 1½	23 „ 0 „ 3
75 „ 3 „ 2	65 „ 2 „ 2 „ 0¼	12 „ 2 „ 9
46 „ 1 „ 3	54 „ 1 „ 3 „ 1	9 „ 1 „ 0

LONG MEASURE.

Miles. fur. po. yds.	miles. fur. yds. ft. in.	leag. miles. fur.
87 „ 7 „ 39 „ 5	146 „ 4 „ 190 „ 2 „ 11	150 „ 2 „ 7
76 „ 6 „ 18 „ 4½	73 „ 6 „ 11 „ 1 „ 10	84 „ 1 „ 6
65 „ 5 „ 24 „ 3	174 „ 5 „ 119 „ 0 „ 9	112 „ 2 „ 5
54 „ 3 „ 16 „ 2¾	386 „ 3 „ 124 „ 1 „ 11	98 „ 1 „ 4
43 „ 2 „ 32 „ 0	63 „ 2 „ 219 „ 2 „ 8	35 „ 0 „ 3
32 „ 1 „ 37 „ 4½	761 „ 0 „ 110 „ 1 „ 6	123 „ 1 „ 2
21 „ 4 „ 30 „ 3	489 „ 6 „ 67 „ 0 „ 10	69 „ 1 „ 1
30 „ 0 „ 25 „ 2¼	38 „ 4 „ 100 „ 2 „ 9	42 „ 0 „ 6
19 „ 6 „ 29 „ 1	167 „ 3 „ 148 „ 1 „ 8	36 „ 2 „ 7
9 „ 3 „ 36 „ 4¾	75 „ 1 „ 84 „ 1 „ 6	19 „ 1 „ 5

LAND MEASURE.

Acres. ro. per.	acres. ro. per. yds.	acres. ro. per.
67 „ 3 „ 39	325 „ 2 „ 25 „ 30	123 „ 1 „ 38
34 „ 1 „ 21	212 „ 1 „ 18 „ 19¾	110 „ 3 „ 34
52 „ 2 „ 25	169 „ 3 „ 27 „ 28½	98 „ 2 „ 29
70 „ 1 „ 18	105 „ 2 „ 21 „ 27	87 „ 0 „ 18
45 „ 1 „ 26	198 „ 2 „ 35 „ 16½	76 „ 1 „ 10
23 „ 0 „ 32	45 „ 1 „ 14 „ 25	65 „ 2 „ 15
18 „ 3 „ 19	180 „ 1 „ 16 „ 29¼	54 „ 3 „ 18
32 „ 2 „ 10	96 „ 0 „ 18 „ 10	43 „ 2 „ 14
54 „ 2 „ 8	75 „ 1 „ 32 „ 15¾	32 „ 0 „ 12
15 „ 1 „ 12	67 „ 1 „ 19 „ 20	21 „ 1 „ 9

WINE MEASURE.

Gals. qts. pt.	hhds. gals. pts.	tuns. hhds. gals.	tun. pip. gals.
62 „ 3 „ 1	67 „ 62 „ 7	110 „ 3 „ 60	78 „ 1 „ 125
48 „ 2 „ 0	54 „ 59 „ 6	98 „ 2 „ 56	89 „ 0 „ 108
54 „ 1 „ 1	43 „ 45 „ 5	87 „ 1 „ 40	67 „ 1 „ 112
32 „ 2 „ 1	32 „ 36 „ 7	76 „ 3 „ 48	56 „ 1 „ 96
60 „ 0 „ 1	21 „ 12 „ 3	65 „ 1 „ 35	47 „ 0 „ 121
56 „ 1 „ 0	10 „ 56 „ 2	54 „ 0 „ 23	35 „ 1 „ 100
19 „ 3 „ 1	9 „ 30 „ 4	43 „ 3 „ 27	28 „ 0 „ 87
25 „ 2 „ 0	8 „ 28 „ 3	32 „ 2 „ 54	26 „ 1 „ 75
16 „ 1 „ 1	7 „ 42 „ 7	21 „ 1 „ 36	17 „ 1 „ 68
12 „ 0 „ 1	6 „ 19 „ 6	19 „ 3 „ 18	12 „ 1 „ 69

ALE or BEER MEASURE.

Gals. qt. pt.	bar. fir. gals. pt.	hhds. gals. qt.
50 . 3 . 1	123 . 1 . 8 . 7	144 . 53 . 3
49 . 0 . 1	112 . 2 . 5 . 6	109 . 48 . 1
38 . 1 . 0	110 . 0 . 7 . 7	110 . 36 . 0
27 . 2 . 1	105 . 3 . 6 . 5	38 . 50 . 2
16 . 3 . 1	102 . 1 . 4 . 4	96 . 45 . 1
12 . 1 . 0	100 . 2 . 3 . 6	75 . 37 . 3
10 . 2 . 1	98 . 0 . 5 . 0	64 . 25 . 2
9 . 1 . 0	96 . 3 . 6 . 5	37 . 50 . 1
8 . 3 . 1	94 . 2 . 7 . 7	29 . 34 . 0
7 . 2 . 1	90 . 1 . 8 . 6	15 . 18 . 2

CORN MEASURE.

Qrs. bus. pecks.	lasts. qr. bus. pecks.	loads. qr. bus.
125 . 7 . 3	98 . 9 . 7 . 2	137 . 4 . 6
84 . 3 . 2	87 . 7 . 6 . 3	95 . 3 . 5
132 . 5 . 1	76 . 0 . 4 . 1	68 . 1 . 4
76 . 6 . 0	65 . 5 . 5 . 2	84 . 2 . 5
57 . 2 . 3	54 . 6 . 3 . 1	56 . 0 . 3
63 . 4 . 1	43 . 8 . 4 . 3	45 . 3 . 6
36 . 6 . 2	32 . 4 . 5 . 2	81 . 1 . 7
128 . 5 . 3	21 . 5 . 6 . 3	63 . 2 . 5
45 . 3 . 0	10 . 3 . 4 . 0	24 . 4 . 4
29 . 4 . 1	9 . 7 . 3 . 1	19 . 3 . 3

MEASURE OF TIME.

Years. days.	days. ho. min. sec.	mo. we. da.
135 . 292	168 . 21 . 55 . 59	12 . 3 . 6
316 . 219	84 . 18 . 50 . 32	9 . 2 . 1
168 . 146	76 . 16 . 45 . 48	16 . 1 . 5
10 . 73	36 . 12 . 40 . 11	11 . 2 . 4
146 . 121	119 . 19 . 35 . 33	10 . 1 . 3
73 . 62	25 . 8 . 30 . 34	5 . 3 . 2
219 . 30	10 . 21 . 25 . 17	7 . 0 . 6
30 . 108	128 . 14 . 20 . 28	6 . 1 . 4
96 . 28	36 . 11 . 15 . 54	14 . 2 . 5
52 . 110	12 . 9 . 10 . 21	3 . 1 . 3

QUESTIONS FOR PRACTICE.

1. There are two sums of money, the greater is 21 guineas, and the less £11„19„6: how much do they amount to?

2. Lent the following sums:—£10„15, four guineas, 15 shillings, and a dollar, 4/6: how much cash should I receive?

3. After paying £10 of a debt, there remained due nine guineas and a half: required how much the debt amounted to.

4. A person expends on a journey £15„14„10, and brings home three guineas and a half: required how much the debt amounted to.

5. A person owed a sum of money, and paid, at different times, 19 guineas, £37„10, and £15„10„6; and the balance still owing, is £57„10„6: how much was the original debt?

6. A merchant has in bank-notes £175„10, in gold 21 guineas, in silver 19/6, in copper 7/9, and a bill due for £96„11„10: how much do these sums amount to?

7. A purchased goods to the amount of £432„11„8; he paid freight £11„7„6, other charges £6„13„10; and he gained by the sales £112„10„3: how much did he sell them for?

8. The cost of a shipment of goods to the West Indies was £1250„10; the amount of charges £45„14„7; commission £32„8„3; insurance £57„10„9: required the amount of the invoice.

9. Seven bags of dollars, each containing one thousand, weighed as follows:—Nos. 1, 2, 3. each 72 lb. 1 oz. 10 dwt.; No. 4. 72„3„0; No. 5. 72„2„0; and Nos. 6. and 7. each 72„2„10: required the whole weight.

10. Received from A, £150„15„4; from B, twice as much; from C, as much as from all the rest: what is the total sum?

11. In settling a half-year's rent with my landlord, I paid him £7„10„6, which, including 18/10 for repairs which I have done, and £4„3„2 for goods bought of me, amounts to his receipt for rent: required the yearly rent of my house.

12. A jeweller purchased two pieces of gold plate, weighing 11 dwt. 20 grains; three gold rings, 8 dwt. 6 grs.; five gold bracelets, 1 oz. 15 dwt. 12 grs.; and two gold ear-rings, 2 dwt. 20 grs.: what is the weight of the whole?

13. The weight of six bales of cotton was as follows:—No. 1., 2 Cwt. 2 qrs. 17 lb.; No, 2., 2„3„10; No. 3., 2„2„21; No. 4., 2„1„27; No. 5. 2„3„0; and No. 6., 2„2„11: required the weight of the whole.

14. A merchant's clerk having been sent out for payment of some bills, he received from A, £62„10; from B, £75„12„6; C, £46„19; from D, 20 guineas; and from E, £27„15: how much did he receive altogether?

15. A book-keeper received from his master a certain sum to pay a bill of £109„11„7, and returned him £10„8„5 of balance: how much money did he receive from his master?

16. A grocer bought seven chests of tea, No. 1. weighs 3 qrs. 24 lbs.; *No. 2., 1 Cwt. 12 lbs.;* No. 3., 1 Cwt. 1 qr. 8 lbs.; No. 4., 2 qrs. 26 lbs.;

No. 5. 3 qrs. 21 lbs.; No. 6. 1 Cwt. 17 lbs.; No. 7. 3 qrs. 25 lbs. What is the weight of them?

17. A woollen-draper, on taking an inventory of his shop, finds he has 56 yds. 1 qr. 3 na. of blue cloth; 49 yds. 3 qrs. 2 na. black; 84 yds. 3 nails brown; 65 yds. 3 qrs. scarlet; and 120 yds. 1 nail mixt. Required the amount?

18. A wine-merchant has in his cellar, 2 pipes 48 gals. port; 1 hhd. 60 gals. 5 pints claret; 62 gals. 7 pints madeira; 2 pipes 1 hhd. sherry; 1 pipe 36 gals. Lisbon. Required the amount of his stock?

19. A surveyor measured three farms, the contents of which were as follows:—A.'s farm, 59 acres 2 roods 25 perches, besides a garden of 3½ roods; B.'s, 65½ acres, and a garden of 4½ roods; C.'s, 74 acres 30 perches, besides a garden of 2 roods 28 perches. How much land do these three farms contain?

20. A gentleman rented five fields; the *first*, which measured 7 acres 2 ro. 25 p., for £37„5„7; the *second*, 6 acres 3 ro. 18 p., for £33„19„6; the *third*, 5 acres 1 ro. 19 p., for £26„19„10; the *fourth*, 4 acres 2 ro. 15 p., for £22„19„8; and the *fifth*, 3 acres 3 ro. 28 p., for £19„12„6. How much do these fields measure, and how much rent will he draw yearly?

21. From London to Biggleswade is 46 miles 2 fur. 18 poles 3½ yds., from that to Stilton 20 miles 19 poles; to Newark 50 miles 1 fur, 17 poles 4 yds.; to Doncaster 37 miles 1 fur. 7 yds. 2 feet; to York 37 miles 12 poles 1 yd. What is the distance betwixt London and York?

22. A gentleman paid for ground to build on £583„10„6: to the mason, £1268„18„10; carpenter, £1521„17„9; the slater, £198„14„3; the smith, £65„18„6; the glazier, £295„4„10; the painter, £76„10„11; the upholsterer, £220„16„8; and other petty charges to the amount of £19„14„11. Required the net cost of the house?

23. Imported from Lisbon, cotton wool to the amount of £3675„18„6; paid for agent's commission, £90„16„8; freight, £98„17„9½; insurance, £126„13„4; duty, £115„19„10½; shipping charges, £101„14„7. I intend to keep it on hand for some time, and pay for cellar £15„10. How must I sell it to gain £365„15 upon the whole?

24. A corn merchant purchased from A. 145 quarters 3 bushels wheat for £435„7„6; and 199 qrs. 6 bus. barley £350„10„3; from B. 132¼ qrs. oats for £198„15, and 100 qrs. barley for £175„12; from C. 87 qrs. 6 bus. wheat for £310„12„9, and 223½ qrs. barley for £389„15; from D. 118 qrs. oats for £177„13„4; from E. 176 qrs. 7 bus. wheat for £616„17„10, and 430 qrs. 4 bus. barley for £752„10; from F. 215 qrs. 2 bus. oats for £421„9„8, and 112¾ qrs. barley for £196„18„9. Required the stock on hand of each kind, the total amount, and the cost of the whole?

Remarks. In adding the *shillings*, first run up the column of units, and put down the right hand figure of the sum, carrying the

QUERIES.

1. What is Addition?
2. How do you set down integers to be added?
3. Why do you carry by 10 in adding integers?
4. How do you write compound numbers to be added?
5. How do you prove Addition?

SUBTRACTION.

Subtraction is that operation by which we find the difference between two given numbers.

The greater number is called the *minuend*, and the less the *subtrahend.*

Case I. To subtract Integers.

Rule 1. *Place the less number under the greater, units under units, tens under tens, &c.*

2. *Begin at the right-hand, and subtract each figure of the lower line from the figure above it, and set down the remainder.*

3. *When the upper figure is less than the under one, borrow ten to the upper figure, and add one for it to the next figure on the lower line, and proceed as before.*

TO PROVE SUBTRACTION.

Method I. *Add the difference to the less number, and the sum will be equal to the greater.*

II. *Subtract the difference from the minuend, and the remainder will be equal to the subtrahend.*

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rest to the tens; then add the tens, and take half of their sum; if 1 is over, put it down, and carry the quotient to the pounds.

2. In adding grains in Troy weight, lbs. in Avoirdupois, and the like, the learner at first should add the columns of units and tens separately, till he can do that readily, but after some practice he should accustom himself to add both together.

3. Pounds, shillings, pence, and farthings may be added at once, without summing them in separate columns, but as this method burdens the memory, it cannot be much recommended, either for accuracy or expedition.

4. The learner should not consider himself sufficiently expert at addition of money till he can add sums of ten lines in less than half a minute, or 20 lines in a minute, or 30 lines in a minute and a half, and so on. Next in importance to money is cwts., qrs., and lbs., which the learner should add with equal readiness.

EXAMPLES.

From	89675	567895	9543280	81809500
subtract	13424	437560	6087015	9989009
Difference	76251	130335	3456265	71820491
Proof, by method 1.		567895	6087015 *by method* 2.	

EXERCISES.

From	1. 517826	2. 972438	3. 196083	4. 180180
subtract	383714	361474	99804	90909
Difference				

From	5. 4601850	6. 101205	7. 234567	8. 100000000
take	3837140	90819	68765	98765432
Remainder				

9. From 12054860 take 506091.
10. Subtract 99019 from a million.
11. Required the difference of 705043 and 30904.
12. What is the difference of 880008 and 924999?

REMARKS. The reason of borrowing 10, when any figure of the subtrahend is greater than its corresponding figure in the minuend, will appear, if we consider that when two numbers are equally increased by adding the same to both, their difference is not altered. When we proceed according to the rule we add 10 to the minuend, and we likewise add 1 to the next higher place of the subtrahend, which is equal to 10 in the lower place.

2d. Some, where they have occasion to borrow 10, instead of adding 1 to the next figure of the subtrahend, diminish the corresponding figure of the minuend by 1. This is only a different order of proceeding, and gives the same answer; but the established method (as given above) is, on some occasions, more eligible in practice, particularly when the next figure of the minuend is a cypher.

3d. It sometimes happens that one or both numbers require to be previously prepared for subtraction by addition; as, *first*, when two or more numbers are given to be subtracted from one; *second*, when one number is to be subtracted from two or more; and *thirdly*, when several numbers are to be subtracted from several. In the first case add the several parts of the less number together, and subtract their *sum* from the greater. In the second case add together the parts which compose the greater number from their sum; and in the third case add the parts of each number together, and subtract the sum of the less from the sum of the greater.

13. How much does 110001 exceed 99999?

14. How much does 123456789 want of 1000 million?

15. What is the difference betwixt one million and eleven thousand eleven hundred and eleven?

16. From eighteen hundred and seventeen, subtract one thousand and twenty.

17. Find how much must be added to fifteen thousand and five, to make twenty-three thousand?

18. Required the difference of one million, and five hundred thousand and 906506.

19. If 709080706 be taken from a thousand million, what remains?

20. From 9111117 take 8009008, placing the *subtrahena* above the *minuend?*

QUESTIONS FOR PRACTICE.

1. How many days are there from Midsummer till Christmas?

2. How many days from Christmas till Lady-day?

3. How many days from 22d December till 14th May?

4. Magna charta was signed in 1215, and the Habeas Corpus act was passed in 1678, and suspended in 1817: how long is it from each of these periods?

5. London contains 1050000 inhabitants and Edinburgh 102987: how much does the population of the metropolis of England exceed that of Scotland?

6. The number of inhabitants of Great Britain and Ireland is stated at 16456303, of which England contains 9538827, Wales 611788, and Scotland 1805688: how many persons does Ireland contain?

7. How much does the population of France, which is estimated at 27267148, exceed that of Great Britain and Ireland, which, according to the last census, is stated to be 16456303?

8. The amount of assessment for the property tax for one year was £11359229, and the payment into the Exchequer for the same year was only £3100631: required the sum in arrears?

9. The average value of goods exported for several years past amounted to £14950000, and the value imported to £1183300; how much did the annual exportation exceed the importation?

10. A merchant has to pay an open account of £63; a bill of £194; and a purchase for cash £78: he has on hand six 5 pound notes, ten 10 pound notes, and 20 guinea notes: how much money must he require to answer his engagements?

11. A wine and spirit merchant imported from Jamaica 12 puncheons of rum, measuring by the gauge as follows: No. 1, 114 gallons; No. 2, 110 gallons; No. 3, 100 gallons; No. 4, 109 gallons; No. 5, 99 gallons; No. 6, 100 gallons; No. 7, 106 gallons; No. 8, 110 gallons; No. 9, 112 gallons; No. 10, 104 gallons; No. 11, *107 gallons; No.* 12, 102 gallons; he sold Nos. 1, 3, 5, 7, and 9:

how many gallons did he import; how many sold; and how many has he still on hand?

12. The annual revenue of Britain, in one year, was estimated as follows:—Amount of permanent taxes £28882795; land and malt taxes £2475000; profit of the lottery £400000. The annual expenses are, for the navy £6160000; army £30000000; ordnance for land service £500000; miscellaneous services £1000000; civil list £900000; interest of public debt £25314811: required the surplus or deficiency?

CASE II. TO SUBTRACT COMPOUND NUMBERS.

RULE 1. *Place like denominations under like, as pence under pence, shillings under shillings, and pounds under pounds.*

2. *When the under number of any name exceeds that in the upper, add as many to the upper as will make one of the next higher.*

3. *Set down the remainder, and for what you borrowed, add one to the next denomination of the lower line.*

EXAMPLES.

From	£165.18. 9	£210. 4. 6	£368.12. 3
subtract	41.14. 6	125. 9.10	109. 8.10½
Difference	124. 4. 3	84.14. 8	259. 3. 4½

REMARKS. The reason for borrowing here is the same as in simple subtraction. Thus, in subtracting pence we add 12 to the pence column, when we cannot take the pence in the lower line from the pence in the higher; and, at the next step, we add 1 to the shillings; and in like manner we add 20 to the shillings.

2d. It is, perhaps, easier to subtract the number in the lower line when it exceeds that in the upper, from the value of the next higher name, and add the number in the upper line to the difference. Thus, in example 2, 10 pence from 6 pence we cannot, but take 10 from 12, the pence in a shilling, there remains 2; to which 6 being added makes 8.

3d. Though it be the general practice to place the less number under the greater in subtraction, the learner ought to acquire the habit of finding the difference when the greater number is placed under the less, with facility, as this last method is sometimes more convenient; of which instances will frequently occur in the course of his practice.

4th. The learner should also acquire the habit, when two sums are marked down, of placing such a sum or *difference* under the less, as, when added to the less, will be equal to the greater. This operation is the same as subtraction, though conceived in a different manner, and is useful in balancing accounts, and on other occasions.

EXERCISES.

1. From	£160„ 0„ 9	£312„ 7„ 8	£1010„10„ 6
subtract	83„10„10	185„13„ 4½	1809„17„ 0¾
Balance			

4. From	£1163„16„ 7	£109„19„ 9¼	£1260„ 5„10
take	907„12„11¼	21„11„11½	679„19„ 3½
Balance			

5. Gave	£1050„ 0„ 0	£100„ 0„ 0	£1900„ 0„ 0
to pay	919„18„ 7	90„19„ 9¾	1817„10„ 3
Balance			

9. Required the Balances of the following Accounts?

Dr. side.	Cr. side.	Dr. side.	Cr. side.
£168„10„ 6	£291„14„10	£987„13„ 9	£1000„ 0„ 0
450„ 7„10	180„ 8„ 4	876„11„ 8	805„10„ 0
312„14„ 3	324„12„ 3	165„ 4„10	719„ 6„ 9
187„11„ 9	167„10„11	654„13„ 7	446„15„ 6
109„ 9„ 8	75„ 9„ 9	543„ 6„ 8	250„ 9„ 7
95„13„ 4	108„15„10	432„10„11	327„10„ 3
112„ 7„ 3	56„ 6„ 8	321„ 8„ 4	520„ 7„10

10. Made the following Remittances to my Bankers, to answer my several Drafts.

Dr.	A. B. and Co.	Cr.	
To cash	£ 978„11„10	By cash	£1050„ 7„ 9
——	1849„ 9„ 4	——	1817„10„ 7
——	645„13„ 9	——	725„13„ 4
——	1176„ 7„ 6	——	970„ 8„10
——	638„11„ 3	——	898„12„ 6
——	389„ 8„11	——	730„ 5„11
——	510„ 4„ 7	——	565„17„ 8
——	146„19„ 8	——	219„ 4„ 5

Required how much is the *Balance* which I have still to remit.

TROY WEIGHT.

	Ounces dwts. grs.	Lbs. oz. dwts. grs.	Lbs. oz. dwts.
11. From	116 „ 18 „ 20	108 „ 7 „ 10 „ 12	125 „ 8 „ 15
take	87 „ 9 „ 23	79 „ 10 „ 7 „ 20	37 „ 9 „ 18
Rem.			

AVOIRDUPOIS WEIGHT.

		Lbs. oz. drs.	Cwt. qr. lb.	Tons ewt.qr.	St. lb.
14.	From	120,10,11	370,2,10	140,10,1	116,10
	take	17, 3,13	105,3,21	37, 8,3	87,12
	Rem.				

15. Account of the weight of ten Hogsheads of sugar.

No.		Cwt.qr.lb.		Qrs.lb.
No. 1.	Gross	15,2,26	Tare	3,10
2.	——	14,3,17	——	2,18
3.	——	17,0,12	——	3,14
4.	——	16,2,21	——	2,15
5.	——	18,0,27	——	3, 7
6.	——	14,3,18	——	2,12
7.	——	15,2,16	——	3,18
8.	——	16,1,10	——	3,17
9.	——	14,3,19	——	2,21
10.	——	16,2,26	——	3,13

Required the net weight of each hogshead, and the gross, tare, and net weight of the whole?

CLOTH MEASURE.

		Yds.qr.na.	Yds. qr. na. in.	E.ells qr.na.
16.	From	110,2,1	1120,1,2½,1½	180,3,2
	take	69,3,2	195,2,3 ,2	87,2,3
	Rem.			

LONG MEASURE.

		Yds.ft.in.	Miles fur.po.yds.	Lea.mi.fur.
19.	From	145,2, 9	1670,5,28,3	110,1,3
	take	56,0,10	209,6,32,4½	81,2,6
	Rem.			

LAND MEASURE.

		Acres ro.pe.	Acres ro.per.yds.	Acres ro.per.
22.	From	120,2,20	1010,2,30,25	156,3,18
	take	79,2,28	608,3,25,28¼	80,1,35
	Rem.			

WINE AND SPIRIT MEASURE.

		Hhd. gals. pts.	Pip. hhd. gal. qts.	Tun. hhd. gal.
25.	From	108 , 60 , 3	132 , 1 , 45 , 2	120 , 2 , 10
	take	89 , 45 , 7	117 , 0 , 60 , 3	60 , 3 , 38
	Rem.			

ALE AND BEER MEASURE.

	Gal. qt. pt.	Bar. fir. gal.	Butt. hhd. gal. qt.
28. From	210 „ 2 „ 0	43 „ 2 „ 5	124 „ 0 „ 38 „ 2
take	109 „ 3 „ 1	34 „ 3 „ 7	41 „ 1 „ 50 „ 3
Rem.			

CORN AND COAL MEASURE.

	Qrs. bus. pe.	Lasts. qrs. bus. pe.	Score. chal. bus.
31. From	301 „ 5 „ 2	110 „ 8 „ 4 „ 2	156 „ 19 „ 18
take	149 „ 7 „ 3	21 „ 9 „ 6 „ 0	73 „ 20 „ 35
Rem.			

MEASURE OF TIME.

	Days. ho. min.	Years. mo. w. da.	Years. da.
34. From	320 „ 15 „ 45	90 „ 10 „ 2 „ 5	1817 „ 292
take	219 „ 20 „ 54	78 „ 12 „ 0 „ 6	909 „ 356
Rem.			

QUESTIONS FOR PRACTICE.

1. What sum added to £19„19„9½ will make up 50 guineas ?

2. Gave £40 to pay two bills, one of £17„11„10, and the other 22 guineas : how much is the balance ?

3. Sent £120 to pay a bill, and received back £7„14„7 : how much was the bill ?

4. A gentleman bought a gig and horse for 100 guineas, the horse alone cost £37„10 : what was the gig worth more than the horse ?

5. A clerk's salary is 70 guineas; he has received at different times the following sums : £5, £6, 10 guineas, £8„6, £15„10, and 12 guineas. Required how much he can still draw for ?

6. Lent a person £100, and have since received £13„13„6, £1„19, and 20 guineas : how much is still unpaid ?

7. The debit side of an Account in a merchant's ledger contains £1050, and the credit side £561„9„6, £15„17„3, £197„5„7, £41„11„10, and £8„3„9. Required the difference or balance of the account ?

8. A housekeeper receives from her master 3 guineas to defray the expenses of the week ; on Monday she laid out 7/3½, on Tuesday 10/9, on Wednesday 6/10¼, on Thursday 5/8, on Friday 8/7¾, and on Saturday 12/6 : what is the balance in her hands ?

9. A gentleman has an estate of £300 a-year ; but he pays for land-tax 15 guineas, superintending the estate five shillings in the pound, and for repairs one year with another £27„10 : how much is his net income ?

10. The sum granted for the navy in one year was £9951378„13„1, but the demands for the service amounted only to £8174711„14„2¼. *Required the surplus ?*

11. The fund in the three ⅌ cent. consols amounted at one time to £317395183„4„5¼, of which there was redeemed by the land-tax £10454778„1„8, and by the commissioners £29089400. Required the remaining capital of that fund?

12. A quantity of Spanish dollars sold for £1667„5„11, and the charges for freight, bags, and weighing £41„19„7, brokage £2„1„8, and commission £8„6„8. Required the net proceeds?

13. The amount of the sales of 30 hhds. sugar came to £1675„10, the charges were as follow:—Duty £561„9„6, dock dues £15„7„3, freight £197„15„10, primage £22„19„9, interest £5„8„6, brokage £8„3„6, and commission £41„17„9. Required the net proceeds?

14. A bankrupt, at a meeting of his creditors, presented the following state of his affairs:—Goods to the value of £617„10, in open accounts £290„12„9, and two good bills to the amount of £220„13: he owes to A. £430„15, to B. £347„11„6, to C. £275„13„7, to D. £120„18„4, all in open accounts, and in accepted bills lying over unpaid £701„12: how much will his creditors lose?

¶ 15. A silversmith buys 10 lb. 4 oz. silver, out of which he makes a pair of salts, weight, 4 oz. 7 dwts., 12 table spoons, 3 lb. 11 dwt., a cup, 9 oz. 18 dwt., a tankard, 1 lb. 4 oz. 3 dwt., and a tureen, 1 lb. 6 oz. 9 dwts. Required how much silver he has still unwrought?

16. A dealer in teas orders, from the East India warehouse, six chests of Congou, No. 1. weighing gross 3 qrs. 26 lb., No. 2. 1 Cwt. 5 lb., No. 3. 1 Cwt. 7 lb., No. 4. 1 Cwt. 3 lb., No. 5. 3 qrs. 27 lb. No. 6. 1 Cwt. 9 lb. He is allowed 26 lb. on each chest for tare and draft. Required the net weight?

17. A merchant sold to each of two young ladies 9 yards 3 qrs. of printed cloth for a dress, from a piece measuring 29 yards and a quarter: how much cloth has he left?

18. Suppose a person at London and another at York, the distance being 198 miles, to set out at the same time to meet each other on the road. Required how far they are distant when each has travelled 79 miles 5 fur. 200 yards?

19. There are 1560 acres of common to be divided among four persons, of which A. is to have 405 acres 2 roods, B. 390 acres 20 perches, C. 316 acres 3 roods 35 perches, and D. the remainder: how much will fall to his share?

20. A garden contains four acres and a half; the grass-walks measure 3½ roods, the gravel-walks 35 perches 28 yards, and the flower-borders 1 acre 2 roods 15 yards: how much remains for kitchen-garden?

21. A person bought a hogshead of wine, and bottled at one time 8 gals. 2 qts. 1 pint, at another time 5½ gals., at another time 9 gals. 2 pints, and at another time 12 gallons. Required the quantity in the cask?

22. A brewer sells in one month 25 hhds. 5 fir. 4 gals. of strong ale, 32 hhds. 2 fir. 8 gals. of porter, and 10½ hhds. of table beer. He brews, during the same time, 40 hhds. 1 fir. of ale, 35 hhds. of porter, and 20 hhds. 6 gals. of beer: how much has he increased his stock during the month?

23. Another brewer has in his cellars 45 butts 2 barrels of porter, besides 200½ dozen in bottles: he receives orders from A. for 9 butts 2 bar. and 30 dozen of bottled porter, from B. for 12 butts 8 gals., from C. 7 butts 1 kilderkin 15 dozen and 7, from D. 50 dozen and 9: how much will remain after executing these orders?

24. The weight of six hhds. tobacco is as follows: — No. 1. 18 Cwt. 1 qr. 10 lb., tare 1 Cwt. 2 qrs. 19 lb.; No. 2. 19 Cwt. 2 qrs. 12 lb., tare 1„3„5; No. 3. 18 Cwt. 1 qr. 10 lb., tare 1„2„6; No. 4. 18 Cwt. 1 qr. 14 lb., tare 1„2„21; No. 5. 12 Cwt. 3 qrs. 26 lb., tare 1„1„8; No. 6. 12 Cwt. 3 qrs. 5 lb., tare 1„1„13. Required the amount of the gross, tare, and net weights?

25. A farmer's crop for last year was 52 qrs. 5 bushels 3 pecks wheat, 30 qrs. 2 bush. 1 peck barley, 68 qrs. 6 bush. oats, and 40½ qrs. beans. He sold to a corn-factor 37 qrs. 6 bush. wheat, 30 qrs. 2 bush. 2 pecks barley, 49 qrs. 7 bush. 3 pecks oats, and 19 qrs. and 2 pecks beans. Required his stock of each kind on hand?

26. Two neighbouring gentlemen, A. and B., upon adding their ages together, find they amount to 110 years 3 months; now B.'s age is 47 years 8½ months: what is A.'s age, and how much is he older than B.?

27. Required a state of the following debts due to John Noble, Esq.: a bond on W. Jones of £500, and interest £37„10; another of £300, due by J. Gale, of which there is paid £150, interest due £9„18„4; a bill on C. Wells of £98„12„6 due, with interest £1„7„6, and an open account due by E. Weston of £54„11„8.

28. A gentleman's rent is paid by eight tenants; A. pays £250„10„6; B. £265„13„4; C. £287„10„6; D. £220„16„8; E. £276„19„10; F. £490„18„3; G. £365„11„10; H. £289„7„6; his expenses are, for house-keeping, £985„10„8; tradesmen's bills, £560„14„6; merchants' ditto, £438„13„9; carriage and horses, £250„12„7; garden expenses, £67„14„8; duties, £98„10„6; improvement of land, £325„6„6; private expenses, £89„6„10: required what money he saves or what debt he contracts.

29. Paid into my banker's on the 3d Jan. £270„10, on the 20th, 100 guineas, on the 4th Feb. drew for £50, and on the 18th paid in £35; on the 17th March gave a check on them for 80 guineas, and on the 21st another for £28„15; on the 1st April paid in £63, and on the 18th £25; on the 19th May gave a check for £17„14„6, and on the 23d paid them £30; on the 11th June gave a draft on them for £19„5. Required how much I have in the banker's hands?

30. A merchant's gross subject at the beginning of the year was £8749„13„4, and his debts at that time amounted to £2519„8„4. At the end of the year he balances his books, and finds he has in cash £1290„8„4; in goods on hand ℘ inventory £1654„15; in open accounts £2584„1„4, and in notes payable £3138„7„6. His debts in open accounts are £516„18„7, and in acceptances £985„13„9. Required his net stock at the beginning, and also at *the end of the year*, and what he gained or lost during the year?

QUERIES.

1. What is Subtraction?
2. What are the numbers called?
3. How do you set down integers to be subtracted?
4. When the *upper figure* is less than the under one, how do you proceed?
5. Since you borrow 10 to the upper figure, how do you add only 1 to the next figure in the lower line?
6. How do you set down compound numbers to be subtracted?
7. How do you proceed when the under number of any denomination exceeds that in the upper?
8. How do you prove Subtraction?

MULTIPLICATION.

Multiplication is that operation by which we find the amount of any two numbers, when the one is to be reckoned as many times as there are units in the other; and it serves instead of many additions.

The number to be multiplied is called the *multiplicand*, that by which we multiply, the *multiplier*, both of which are often called *factors*; and the result of these two is called the *product*.

Multiplication Table.

2 Times	1 is	2	4 Times	6 is	24	7 Times	8 is	56
	2	4		7	28		9	63
	3	6		8	32		10	70
	4	8		9	36		11	77
	5	10		10	40		12	84
	6	12		11	44			
	7	14		12	48	8 Times	8 is	64
	8	16					9	72
	9	18	5 Times	5 is	25		10	80
	10	20		6	30		11	88
	11	22		7	35		12	96
	12	24		8	40			
				9	45	9 Times	9 is	81
3 Times	3 is	9		10	50		10	90
	4	12		11	55		11	99
	5	15		12	60		12	108
	6	18						
	7	21	6 Times	6 is	36	10Times	10 is	100
	8	24		7	42		11	110
	9	27		8	48		12	120
	10	30		9	54			
	11	33		10	60	11 Times	11 is	121
	12	36		11	66		12	132
				12	72			
4 Times	4 is	16				12Times	12 is	144
	5	20	7 Times	7 is	49		13	156

CASE I. TO MULTIPLY INTEGERS.

RULE 1. *When the multiplier does not exceed* 12, *begin at the units' place and multiply each figure of the multiplicand, carrying by* 10, *as in Addition.*

PROOF. *Revise the work, or cast out the nines.**

EXAMPLES.

1. Mult. 98765432
by 2
197530864

2. Mult. 50819 or 50819
by 11 50819
559009 559009

EXERCISES.

1. Mult. 865432 by 3
3

2. Mult. 1916086 by 4
4

3. Mult. 5167234 by 5
5

4. Mult. 6705095 by 6
6

5. Mult. 9876543 by 7
7

6. Mult. 6160843 by 8
8

7. Mult. 98765432 by 9
9

8. Mult. 1789064 by 10
10

9. Mult. 12345678 by 11
11

10. Mult. 80818096 by 12
12

---

* To prove multiplication by casting out the 9's, proceed thus:— Cast the 9's out of both factors, and multiply the remainders together; what remains, after casting the 9's out of their product, will be equal to what remains, after casting the 9's out of the total product.

This method is very expeditious, but fallible; for if an error of 9 or any of its multiples, or if a figure is placed or reckoned in a wrong column, the results will nevertheless agree, and so the error remain undiscovered.

The most certain method of proving multiplication is to divide the *product by eith*[illegible] the quotient will give the other.

Rule 2. *When the multiplier consists of several figures; multiply by each figure separately, observing to place the first figure of each product under the figure by which you are multiplying: then add the products.*

Proof. *Cast out the nines: or, multiply the multiplier by the multiplicand, and the product will be the same as formerly.*

EXAMPLES.

1. Mult. 1238 by 432

Method I.	Method II.	Method III.
1238	432	1238
432	1238	432
2476	3456	4952
3714	1296	3714
4952	5184	2476
534816	534816	534816

2. Mult. 8654230
60500
4327115
5192538
523580915000

Proof, by the cross.
2
1×2
2

EXERCISES.

1. Mult. 483725 by 13
2. ...... 196057 by 17
3. ...... 318564 by 19
4. ...... 789036 by 21
5. ...... 2456783 by 32
6. ...... 398765 by 43
7. ...... 103219 by 54
8. ...... 761328 by 65
9. ...... 1210803 by 76
10. ...... 5256542 by 87
11. ...... 987654 by 98
12. ...... 3456789 by 123
13. Mult. 98765432 by 321
14. ...... 7987654 by 654
15. ...... 19080739 by 987
16. ...... 3818208 by 500
17. ...... 73094165 by 1200
18. ...... 34567897 by 706
19. ...... 6473254 by 915
20. ...... 12606169 by 1207
21. ...... 8143203 by 9008
22. ...... 25186546 by 1109
23. ...... 9438700 by 1800
24. ...... 41687400 by 98700
25. Multiply 8765432 by 39, 75, 94, separately
28. Multiply 9876500 by 113, 245, 678, 910, 1814, 56789
34. Multiply 780456 by 30, 70, 110, 4600, 8005
37. Multiply 1956800 by 125, 431, 7300, 51100

Remarks. We may make either of the factors the multiplier, as is most convenient; for 1238 multiplied by 432, gives the same product or result as 432 multiplied by 1238, as in Method II. above; and the like holds true of any other numbers.

2. It would answer equally, in all cases, to begin the work at the highest place of the multiplier, as in Method III.

3. If there are ciphers annexed to any or both factors, we may neglect in the multiplying, and annex them to the product; as in Example 2.

4. If the multiplier be 10, we have only to add a cipher to the multiplicand. If the multiplier be 100, we annex two ciphers, and so on.

CONTRACTIONS.

I. When the multiplier is a composite number, we may multiply successively by the component parts.

Exam. 86543 by 36	86543	86543
12	6	9
1038516	519258	778887
3	6	4
3115548	3115548	3115548

Elucidation. In the above example we may either multiply by 12 and 3, or by 6 and 6, or by 9 and 4, as these are all component parts of 36.

EXERCISES.

1. Multiply 3765489 by 18, 22, 36, 45, 54.
6. Multiply 9087065 by 64, 84, 108, 121, 144.

II. To multiply by 9, which is one less than 10, we may annex a cipher, and subtract the multiplicand from itself thus increased; and to multiply 999 or any number of 9's, annex as many ciphers as there are 9's, and subtract the multiplicand as before. A like rule may be found though the unit figure be not 9, which we leave to the learner to discover.

Ex. 1. 6752 by 9
67520
6752
60768

Ex. 2. 3486 by 999
3486000
3486
3482514

EXERCISES.
1. 5438 by 99
2. 87364 by 9999
3. 16836 by 998
4. 39853 by 997
5. 6845 by 995

III. When one part of the multiplier is an even part of another, the product of two or more figures may be obtained at once from the product of a figure already found.

Ex. 1. 17864
3612
214368
643104
64524768

Ex. 2. 6543872
192648
52350976
418807808
1256423424
1260663853056

EXERCISES.
1. 3852 by 147
2. 16827 by 426
3. 5695 by 4812
4. 14231 by 13212
5. 79562 by 98497
6. 82413 by 112567
7. 364296 by 216729

Elucidation. In Example 1. we multiply first by 12, and then that product by 3, because 3 times 12 are equal to the next two figures, 36.

In Example 2. we multiply first by 8; then, because 8 times 8 are 64 (the next two figures), we multiply the first line of the product by 8: and, because 3 times 64 are 192 (the next three figures), we multiply the second line of the product by 3.

Note. When we follow this method, we must observe to place *the right-hand of each product under the right-hand figure of that of the multiplier from which it is derived.*

QUESTIONS FOR PRACTICE.

1. How many men in an army composed of 94 battalions, each 320 men?

2. How often does the hammer of a clock strike in a year, or in 365 days?

3. How many dollars in 99 bags, each containing 999 dollars?

4. How many loaves of ammunition-bread in 250 waggons, each containing 320 loaves?

5. How many grains of wheat in a quarter, when a pint contains 7680 grains?

6. How many yards of cloth in 19 bales, each 13 pieces, and each piece at an average of 56 yards?

7. How often, during a life of 80 years, does the pulse beat, at the rate of 70 times ℘ minute?

8. How much hay will grow on 123 acres, supposing two crops, the first 234 stones, and the second 78 stones ℘ acre, distinguishing the crops?

9. How many letters in a book of 18 volumes, each 625 pages, each page 47 lines, and each line 42 letters?

10. How many persons inhabit an island which contains 56 counties, each 35 parishes, and each parish 99 families of 7 persons?

11. How many grains of corn in the produce of a field 460 yards long, divided into 325 drills, allowing 15 plants to each yard in length, 12 stalks to each plant, and 19 grains to each stalk?

12. How many fishes will be caught by 14 boats, employed for 30 days, drawing 15 times a-day, and taking at an average 13 fishes each draught?

13. How many changes may be rung upon the ten bells in the steeple of St. Peter's church, Leeds?

14. In an army of 19968 men, it was found that their pay on an average came to £2 ℘ week: how much money must be issued quarterly for their subsistence?

15. How many balls must be provided for 650 gun-boats, each carrying 12 guns, so as the whole fleet may have 39 rounds of shot?

16. How many inhabitants in England and Wales, which contain 57233 square miles, and 177 inhabitants to each mile?

17. How many seeds will be produced from one plant, which bears 15 stalks, each 12 flowers, and each flower 48 seeds?

18. If an acre of grass feed 3 cows, and each cow yields 14 pints of milk ℘ day; how many pints of milk may, at that rate, be expected weekly from a meadow of 32 acres?

19. The silk-mill at Derby throws off at the rate of 24576 yards each minute, how many yards will be produced in a year, working ten hours every lawful day?

20. A cotton-mill of four stories has in each 8 jennies of 216 spindles; supposing each spindle to produce 3 hanks of yarn ℘ day,

how many hanks will be spun in a year, allowing 65 days for Sundays and holidays?

CASE II. TO MULTIPLY COMPOUND NUMBERS.

RULE 1. *When the multiplier does not exceed* 12; *begin at the lowest denominations, and carry as in Addition of the same name.*

EXAMPLES.

1. Mult. £2„13„9½ by 3	2. Mult. 15 Cwt. 2 qrs. 10 lb. by 7
3	cwt. qr. lb.
Answ. £8„ 1„4½	15 „ 2 „ 10
	7
	Answ. 109 „ 0 „ 14

EXERCISES.

1. Mult. £ 4„11„ 8½ by 2
2. .... 1„14„10 by 3
3. .... 2„10„11¾ by 4
4. .... 0„17„ 9¼ by 5
5. .... 0„18„ 6 by 6
6. .... 1„ 2„ 3¼ by 7
7. Mult. £ 0„12„11 by 8
8. .... 3„ 4„ 5 by 9
9. .... 0„ 6„ 8 by 10
10. .... 1„17„ 6 by 11
11. .... 5„11„11 by 12
12. .... 0„ 3„10½ by 9

¶ 13. Multiply 7 lb. 9 oz. 18 dwt. by 6
14. .... 14 Cwt. 2 qr. 19 lb. by 9
15. .... 9 tons 12 cwt. 2 qr. by 5
16. .... 25 yards 3 qrs. 2 nails by 10
17. .... 45 miles 7 fur. 35 poles by 9
18. .... 19 acres 3 roods 39 perches by 11
19. .... 56 gallons 2 quarts 1 pint by 8
20. .... 14 qrs. 5 bushels 3 pecks by 12

RULE 2. *When the multiplier is a composite number; multiply first by one of the component parts, and then that product by the other.*

EXAMPLES.

Method I.		Method II.		Method III.
Mult. £ 5„12„7½ by 16		£ 5„12„ 7½		£ 5„12„7½×4
8*		4		12
45„ 1„0	or	22„10„ 6	or	67„11„ 6
2		4		22„10„ 6
£90„2„0		£90„ 2„ 0		£90„ 2„ 0

---

* The component parts will answer in any order; but it is best, when it can be done, to take them in such order as will clear off some of the lower denominations at the first multiplication, as in Method I. And the work may be proved by taking the component parts in a different order, as in Method II.; or we may multiply by 12, and the top line by 4, and add the products, which are equal to 16.

EXERCISES.

1. Mult. £0„11„ 8 by 15
2. .... 3„ 2„ 6 by 18
3. .... 0„ 3„10¼ by 20
4. .... 1„14„ 3 by 32
5. .... 0„ 5„ 9¾ by 45
6. .... 2„ 6„ 7 by 54
7. Mult. £1„ 7„11 by 63
8. .... 2„ 8„ 4 by 72
9. .... 1„11„ 6 by 84
10. .... 0„19„ 4 by 96
11. .... 1„ 2„ 5½ by 110
12. .... 5„13„ 4 by 132

¶ 13. Multiply 3 lb. 15 dwt. 20 grs. by 14
14. .... 12 Cwt. 1 qr. 27 lb. by 21
15. .... 9 tons 18 cwt. 3 qrs. by 30
16. .... 17 Eng. ells 4 qrs. 2 nails by 42
17. .... 5 yards 2 feet 10 inches by 56
18. .... 36 acres 1 rood 19 perches by 64
19. .... 12 barrels 25 gallons 3 quarts by 70
20. .... 9 quarters 6 bus. 2 pecks by 81

Rule 3. *When the multiplier is not composite, nor exceeds* 156, *multiply by two numbers which come nearest the given number; then multiply the first line by the difference between this number and the multiplier; place the product under the other, and add them.*

EXAMPLES.

Mult. £ 2„11„ 8¾ by 29.
4
10„ 6„11
7
27„ 8„ 5
2„11„ 8¾
£ 75„ 0„ 1¾

lb. oz.drs.
Mult. 1„ 8„ 7 by 26
5
7„10„ 3
5
38„ 2„15
1„ 8„ 7
lb. 39„11„6

EXERCISES.

1. Mult. £ 0„13„ 6¼ by 17
2. .... 0„ 6„ 8 by 23
3. .... 1„10„ 7½ by 31
4. .... 0„17„ 9 by 43
5. .... 11„ 8„ 4 by 57
6. .... 2„12„10½ by 65
7. Mult. £3„ 4„ 2 by 76
8. .... 0„10„11¾ by 87
9. .... 1„14„ 3¼ by 98
10. .... 0„15„ 1½ by 102
11. .... 3„16„ 5 by 135
12. .... 1„ 7„ 9¾ by 156

¶ 13. Multiply 3 dwt. 21 grains by 26
14. .... 15 Cwt. 2 qr. 18 lb. by 47
15. .... 3 yards 1 foot 7 inches by 38
16. .... 5 miles 3 fur. 17 poles by 53
17. .... 2 hhds. 60 gals. 3 qts. by 29
18. .... 7 bushels 3 pecks by 62

18. Multiply 30 days 12 hours 36 minutes by 89
20. .... 13 weeks 6 days 10 hours by 73.

Rule 4. *When the multiplier is large, multiply by* 10, *then that product by* 10, *which will be the value of* 100. *If necessary, multiply this last line by* 10, *which will make* 1000, *and so on: then multiply any line or lines by as many as are wanting of that name, and add the products.*

EXAMPLE.

Multiply 3/5½ by 4567.

£0„ 3„ 5½	× 7	=	£1„ 4„ 2½	=	7 times
10					
1„14„ 7	× 6	=	10„ 7„ 6	=	60 times
10					
17„ 5„10	× 5	=	86„ 9„ 2	=	500 times
10					
172„18„ 4	× 4	=	691„13„ 4	=	4000 times.
	Answer		£789„14„ 2½	=	4567

EXERCISES.

1. Mult. £1„11„ 4 by 189
2. ...... 0„13„11½ by 234
3. ...... 3„ 1„ 8 by 567
4. ...... 0„ 2„ 5¼ by 890
5. Mult. £2„ 9„ 3½ by 910
6. ...... 0„ 4„10 by 1016
7. ...... 4„18„ 7¾ by 1204
8. ...... 1„ 2„ 9 by 10787

¶ 9. Multiply 3 lb. 9 oz. 12 grains by 195
10. .... 14 Cwt. 1 qr. 19 lb. by 321
11. .... 3 stones 12 lb. 10 oz. by 408
12. .... 2 furl. 38 poles 4½ yds. by 1760

APPLICATION OF MULTIPLICATION.

The use of multiplication is to compute the amount of any number of articles, either in respect of value, weight, measure, or any other consideration. The multiplicand expresses how much is to be reckoned for each article; and the multiplier points out the number of articles to be reckoned.

First, *To find the value of any number of articles, multiply the price of a single article by the number.*

EXERCISES.

1. Find the value of 12 ounces of silver @ 5/3
2. .... 17 lbs. congou tea @ 7/6
3. .... 23 Cwt. brown sugar @ 79/4

4. Find the value of 36 stones Spanish wool @ 29/8
5. .... 45 yards woollen cloth @ 22/6
6. .... 54 acres of land @ 30 guineas
7. .... 68 feet of mahogany @ 31/9
8. .... 89 dozen of wine @ 52/6
9. .... 98 gallons of strong ale @ 2/11
10. .... 123 quarters wheat @ 87/6
11. .... 210 chaldron coals @ 13/9
12. .... 365 loads hay @ £4.9.8

Secondly, *To find the weight or measure of any number of articles, multiply the weight or measure of a single article by the given number.*

EXERCISES.

13. Find the weight of 99 parcels of tea, each 7 lb. 9 oz.
14. .... 1000 Spanish dollars, each 16 dwt. 22 grs.
15. .... 160 bales cotton, each 3 Cwt. 1 qr. 23 lb.
16. .... 56 casks tallow, each 9 Cwt. 3 qrs. 19 lb.
17. .... 19 shillings, each 3 dwt. 20 grs.
18. .... 100 guineas, each 5 dwt. 9½ grs.
¶ 19. Find the measure of 19 farms, each 89 acres 3 roods 25 perch.
20. .... 50 pieces printed cloth, each 28 yds. 3 qrs.
21. .... 14 rooms, each 31 sq. yds. 6 feet 9 inches
22. .... 13 carpets, each 42 square yds. 8½ feet

Thirdly, *To find the amount of work done, interest incurred, provisions consumed, or any other thing which increases by length of time, multiply the given rate ⅌ day, month, or year, by the given number of days, months, or years.*

EXERCISES.

23. How much ditching will a man perform in 28 days, at the rate of 2 poles 1 yard 2 feet each day?

24. If a mason build 13 yards 2 feet 6 inches of a wall in a week, how many yards will he build in a quarter of a year?

25. How much is the interest of a sum for a year which yields 6/1 ⅌ day?

26. If the inhabitants of a village consume 99 stones 13 lb. 8 oz. of flour for bread each week, how much flour will they use in the year?

27. How many miles will a person travel in three weeks at the rate of 30 miles 7 furlongs 35 poles each day?

Fourthly, *To find how many of any lower denomination are contained in a given number of a higher, multiply by as many of the lower, as make one of the higher; adding the number of the lower name, if any.*

EXAMPLES.

1. Reduce £154„18„6¾ to farthings.

£154„18„6¾
20
shil. 3098 (add 18)
12
pence 37182 (add 6d.)
4
far. 148731 (add ¾)

2. Red. 68 Cwt. 1qr. 16 lb. to lbs.

4
qr. 273 (add 1 qr.)
28
2190
547
lbs. 7660 (add 16 lb.)

SHORT METHODS OF REDUCING.

Cwts. qrs. and *lbs.* may be very expeditiously reduced into lbs., by placing the *Cwts.* in such a direction as will increase them 112 times, when added as in the two first methods which follow; or by multiplying the *Cwts.* by 12 (adding the odd weights mentally) and placing the product under the *Cwts.* given, two places to the right, the sum will give the lbs. as in Method III.

Thus in the above example, wrought by the usual method.

Method I.
Cwt.qr.lb.
68„1„16
68
68
6844 = 1 qr. 16 lb.
7660 lbs.

Method II.
68
68
136
44 odd wt.
7660 lb.

Method III.
68„1„16
860
7660

EXERCISES.

28. How many pence in £ 999„19„11?
29. How many halfpence in £ 2150„12„9½?
30. How many farthings in £1867„8„7¾?
31. How many sixpences in £ 1234„19„6?
32. How many four-pences in £ 109„7„8?
33. How many three-pences in £ 540„12„9?
34. How many two-pences in £ 212„13„2?
35. How many grains in 9 lb. 8 oz. 9 dwt. 11 gr.?
36. How many dwts. in 156 lb. 7 oz. 15 dwt.?
37. How many drams in 42 lb. 12 oz. 15 drs.?
38. How many lbs. in 36 Cwt. 2 qrs. 16 lb.?
39. How many quarters in 19 tons 18 cwt. 3 qrs.?
40. How many nails in 67 yards 3 qrs. 2 nails?
41. How many inches in 185 yards 1 qr. of cloth?
42. How many yards in 492 miles 7 fur. 35 poles?
43. How many perches in 3695 acres 3 roods?
44. How many square yards in 1680 acres 1 rood 38 poles?
45. How many pints wine in 1185 gallons 3 quarts 1 pint?
46. How many gallons ale in 108 gallons 33 quarts?
47. How many quarts beer in 144 hhds. 50 gallons 2 quarts?
48. How many pecks corn in 1849 quarts 7 bushels?
49. *How many* bushels in 450 lasts 9 quarters 5 bushels?

50. How many hours in 126 years 219 days?

51. How many seconds in 365 days 5 ho. 48 min. 49 seconds?

PROMISCUOUS QUESTIONS.

1. How many bottles of wine in 103 casks, each containing 9½ dozens?

2. How many dozen and single bottles in 136 and 3 dozen of bottles?

3. A ship's company, consisting of 450 men, had each 21 guineas of prize money: how many pounds were distributed?

4. A lottery, consisting of 6500 tickets, was sold at 18 guineas: what did the sum amount to?

5. How much is the yearly income of a person who has 17/6 each week?

6. How much does a bankrupt pay a creditor, to whom he owes £500 @ 13/4 ⅌ pound?

7. What cost a pipe of sherry-wine containing 130 gallons, @ 3/9 a pint?

8. What cost 50 dozen of port wine @ 3/7½ ⅌ bottle?

9. Find the cost of 132 gallons rum @ 3/11 ⅌ bottle, allowing 5½ bottles to the gallon?

10. How much is the expense of painting a room which measures 219 yards, @ 10½d. a yard.

11. How much money will pay 25 men a month's wages at half-a-guinea ⅌ week?

12. How many bottles of wine in 18 pipes at the rate of 52 dozen 9 bottles ⅌ pipe?

13. Required the pay of 9 companies of 50 men each, for three weeks at 13¾d. ⅌ day to each man?

14. What sum will pay off 320 sailors, at £3„7„6 per month for 18 months?

15. At a public meeting 109 gentlemen dined together, and each paid 16/8; how much did their bill come to?

16. How many drops may be cast out of a fodder of lead, or 19 cwt. 2 qr., allowing 60 to the ounce?

17. What is the value of 20 boxes moulded candles, each containing 4 dozen and 5 lb., @ 10½ per lb.?

18. How much cloth will it require to give 950 soldiers new coats, allowing to each 1 yard and 3 nails?

19. Find the cost of 15 boxes white soap, each 2 qrs. 14 lb. @ 84/6 per cwt.?

20. Required the capital of a trading company, consisting of 240 shares, each £166„13„4d.?

21. An estate renting £1527„11„8d. a year, was sold @ 16 years purchase: required the amount of the purchase money?

22. A person expends 13/4 one day with another during the year, and lays up a guinea each week: required his yearly income?

23. If the interest of the national debt at present amount to £1„2„6. each second of time; how much does it amount to ⅌ ann.?

24. A grocer bought at a sale 309 gallons Jamaica rum à 15/3, including the duties, and 67 Cwt. 3 qrs. Muscova sugar at 75/6 per cwt.: required the amount of the purchase?

25. A, whose income is £250 per annum, spent 5 guineas ℘ week, at an average, last year; how much was he in debt at the end of the year, and how much can he afford to spend this year, so as to pay his debt, and reserve 10 guineas besides?

26. How many herrings in a shoal 3 miles long, 2 broad, and 340 yards deep, allowing 72 to the solid yard?

27. If the weight of a cod-fish be 13 lb. Avoir., its roan 2 lb. 3 oz. Troy, and each grain contain 250 seeds; allowing each seed to produce a fish of the same weight; required their number, and weight?

28. If a man thresh 6 sheaves of corn in a day, and each sheaf yields 4½ pecks, and each peck weigh 10 lb.; what quantity and weight will 17 men thresh in 16 weeks?

29. How much corn will grow on 48 acres, at the rate of 4 quarters 3 bushels per acre; and what is the value at 32/6 per qr. and the weight at 3 cwt. 1 qr. 14 lb.?

30. Suppose an army of 20,000 foot soldiers, each having 20 rounds of cartridge with ball; and if the weight of each ball be an ounce, and of the powder 4 drs.; required the whole weight of lead, and of powder?

QUERIES.

1. What is MULTIPLICATION?

2. What names are given to the numbers in this rule?

3. How do you multiply integers when the multiplier consists of several figures?

4. How do you multiply, when ciphers are annexed to any or both factors?

5. How do you multiply, when the multiplier is a composite number?

6. How do you multiply compound numbers?

7. How do you prove MULTIPLICATION in the above cases?

8. How do you find the value of any number of articles, as yards, lbs., or the like?

9. How do you find the weight or measure of any number of articles?

10. How do you find the amount of work done, interest incurred, provisions consumed, or any other thing increased by length of time?

11. How do you find, how many of any lower denomination are contained in a given number of a higher?

DIVISION.

Division is that operation by which we find how often one number is contained in another.

The number to be divided is called the *dividend;* that by which we divide, the *divisor;* and the number of times the divisor is contained in the dividend, the *quotient;* what is over is called the *remainder.*

Case I. To divide Integers.

Rule 1. *When the divisor does not exceed 12, find how often the divisor is contained in the first, or first and second figures of the dividend, and place the quotient under it; prefix (in your own mind) what remains to the next figure in the dividend, and divide as before.*

Proof. *The best method of proving exercises in this Case is to multiply the answer or* quotient *by the divisor, and add the remainder, if any.*

EXAMPLES.

1. Divide 856450 by 5.
5)856450
Ans. 171290
5
Proof 856450

2. Divide 19749925 by 8.
8)19749925
Ans. $2468740\frac{5}{8}$
8
Proof 19749925

EXERCISES.

1. Divide 8432564 by 2
2. .... 980546 by 3
3. .... 1673248 by 4
4. .... 4986089 by 5
5. .... 7308687 by 6
6. Divide 12345678 by 7
7. .... 98765432 by 8
8. .... 888888888 by 9
9. .... 71065430 by 11
10. .... 1481481468 by 12

Rule 2. *When the divisor is more than 12, find how many times the divisor is contained in the first dividual, and place the number in the quotient; multiply the divisor by this number, and subtract the product from the dividual; annex to the remainder the next figure of the dividend for the next dividual, with which proceed as before.*

Note. A dividual is such a part of the dividend as is neither less than the divisor nor equal to its product by 10. In Example 1st, which follows, the dividuals are 61, 157, and 195.

Proof. *Cast the 9's out of the divisor and quotient, and multiply the remainder together; what remains, after casting the 9's out of the product, and adding the remainder, if any, will be equal to what remains after casting the 9's out of the dividend.*

EXAMPLES.

1. Divide 6175 by 23.

```
23)6175    ( 268 quotient
   46··       23
   ───       ───
   157       804
   138       536
   ───        11 rem.
   195       ────
   184       6175 Proof by mul-
   ───       ────  tiplication.
    11
   ═══
```

2. 7812)35161780752(4500996 Ans.

```
7812)35161780752(4500996 Ans.
     31248·····
     ─────
      39137    Proof by casting
      39060     out the 9's.
      ─────          0
       77780        0×6
       70308         0
       ─────
        74995
        70308
        ─────
         46872
         46872
         ═════
```

EXERCISES.

1. Divide	615433 by 13	13. Divide	1815483 by 321
2.	1862086 by 17	14.	6753210 by 654
3.	432174 by 19	15.	10867495 by 987
4.	7360320 by 21	16.	84095326 by 1564
5.	651083 by 32	17.	62914930 by 6095
6.	1165467 by 43	18.	6189685 by 1728
7.	876528 by 54	19.	27878400 by 56789
8.	1310530 by 65	20.	4189684 by 1628
9.	763252 by 76	21.	2655492840 by 9009
10.	2614765 by 87	22.	7842603 by 3205
11.	9267566 by 98	23.	1554584788 by 2197
12.	876543 by 123	24.	60706194584 by 96328

Remarks. In order to prevent mistakes, it is proper to mark with a dot each figure of the dividend as it is brought down.

2. As it is sometimes difficult, when the divisor is large, to discover how often the divisor is contained in the several *individuals*, we may try how often the first figure of the *divisor* is contained in the first figure, or first and second figures, of the *dividend;* that number, diminished by one or two, is generally the quotient figure.

3. If any *product* exceed the *dividual* from which it is to be subtracted, the quotient figure is too great, and must be rubbed out, and a less quotient figure used.

4. If any *remainder* be either equal to, or exceed the divisor, the quotient figure is too small, the last multiplying must be rubbed out, and a greater quotient figure used.

5. If to form a *dividual*, it be necessary to annex to the remainder more figures of the dividend than one, for each figure thus annexed place a cipher in the quotient. This done in Ex. 2.

6. To divide by 10, 100, 1000, or the like, we have only to cut off as many figures on the right of the dividend as there are ciphers in the divisor: the figures which remain on the left, give the quotient, *and those* cut off, the remainder.

25. Divide 1234567890 by 43, 65, 87, 123, 156
29. .... 987654321 by 213, 365, 543, 768, 987
34. .... 53872694 by 73, 146, 219, 292
38. .... 131406570 by 365, 438, 511, 584, 657.

Rule 3. *When a fraction is annexed to the divisor; multiply both divisor and dividend by the under figure of the fraction, adding the upper figure to the product of the divisor; then divide the products.*

EXAMPLES.

1. Divide 9654 by $5\frac{1}{2}$

```
5 1/2 \   9654
2      \     2
--      )-----
11     / 19308
      /  -----
          1755 3/11 Ansr.
          =========
```

2.

```
4 3/4 \   615(1
4      \    4
--      )-----
19     / 2460(129 9/19 Ansr.
          19
          --
          56
          38
          ---
          180
          171
          ---
            9
          ===
```

EXERCISES.

1. Divide 7325 by $2\frac{1}{4}$
2. ....16108 by $7\frac{1}{2}$
3. .... 4567 by $9\frac{3}{4}$
4. Divide 50413 by $8\frac{2}{5}$
5. .... 19320 by $3\frac{5}{6}$
6. .... 87654 by $12\frac{3}{8}$

Rule 4. *To multiply by a mixed number; multiply first by the whole number, then multiply by the upper figure of the fraction, and divide by the under figure, and add the quotient to the former product.*

EXAMPLE.

Mult. 41263 by $11\frac{7}{8}$

```
       11           41263
   ------               7
   453893       ---------
   361051/8     8)288841
   --------     ---------
   489998 1/8      36105 1/8
   ==========
```

EXERCISES.

1. Mult. 5432 by $6\frac{2}{3}$
2. ...... 1984 by $9\frac{3}{4}$
3. ...... 3210 by $12\frac{1}{4}$
4. ...... 8132 by $27\frac{1}{2}$
5. ...... 1675 by $33\frac{1}{3}$
6. ...... 9876 by $52\frac{15}{16}$

Elucidation. In this example we multiply first by 11, the whole number, then we take the multiplicand to a separate place, and multiply it by 7, the upper figure of the fraction, and divide the product by 8, the under figure; or we might have subtracted one eighth from the multiplicand, as the fraction ($\frac{7}{8}$) wants only $\frac{1}{8}$ of unity.

CONTRACTIONS.

1. When the divisor is a composite number, we may divide by the component parts. If there be a remainder from the last division, multiply it by the first divisor, and to the product add the remainder of the first divisor, if any. The sum is the true remainder,

Ex. Divide 72534 by 36.

```
36 { 4|72534          36 { 6|72534          36 {  3|72534
   { 9|18133-2           { 6|12089             { 12|24178
        2014 7                2014-5                 2014-10

 7×4+2=30 rem.         5×6=30 rem.          10×3=30 rem.
```

EXERCISES.

Divide 730146292 by 25, 35, 42, 54, and 63.
Divide 365438511 by 72, 81, 96, 121, and 132.

II. When there are ciphers on the right of the divisor, cut them off, and point off as many figures from the right of the dividend; and when the division is finished, annex the figures pointed off to the remainder.

Ex. Divide 973654 by 6100

```
61,00)9736,54(159 3754/6100
      61··
      363
      305
       586
       549
        3754
```

EXERCISES.

1. 156108 by 310.
2. 627096 by 800.
3. 1516480 by 1100.
4. 7493215 by 7300.
5. 1918600 by 8100.

III. To divide by 9, 99, 999, or a number of 9's, transcribe under the dividend part of the same, shifting the highest figure as many places to the right as there are 9's in the divisor. Transcribe it again, with the like change of places, as often as the length of the dividend admits; add these together, and cut off as many figures from the right of the sum as there are 9's in the divisor. The figures which remain on the left compose the quotient, and those cut off, the remainder.

```
Ex. 1.  99)324123
             3241
               32
          3273,96
Ansr. 3273 96/99

Ex. 3. 999)476523
              476
          476,999
                1
     Ansr. 477
```

```
Ex. 2.  99)547825
             5478
               54
Ansr.     5533,57
                1
Rem.          ,58
```

EXERCISES.

```
1.    99) 67403
2.   999) 23548
3.   999)6748378
4.  9999)5278376
```

Note. If there be any carriage to the unit-place of the quotient, add the number carried likewise to the remainder, as in Ex. 2d; and, if the figures cut off be all 9's, add 1 to the quotient, and there is no *remainder, as in* Ex. 3d.

QUESTIONS FOR PRACTICE.

1. Required the 99th part of a million.

2. How many times is 62½ contained in half a million?

3. If 4704 bottles be packed in 42 casks, how many in each?

4. How many chests, each containing 20 dozen and 10, will contain a million of oranges?

5. How many gallons in a pipe of wine, when 18 pipes contain 2475 gallons?

6. If a traveller for a Mercantile House ride 4550 miles yearly, how many miles does he travel one week with another?

7. If 25 bales of woollen cloths contain 56 pieces, or 44800 yards; how many yards in a bale, and in each piece?

8. How many shirts will a piece of linen make, which measures 52 yards, allowing 3¼ yards each?

9. How many three-pint bottles will be required to contain a hogshead of wine?

10. A carpet contains 900 square feet, and is 25 feet broad; required its length.

11. There are 1440 soldiers to be so ranked that the front is to consist of 96 men; how many men deep is the column?

12. How long will a ship be in sailing from Gibraltar to Malta at the rate of 7 miles an hour, the distance being reckoned at 1106 miles?

13. A circle round the earth measures 24932 miles, how long would a ship take to sail round it at the rate of 6 miles ℘ hour, without interruption?

14. London contains 1,050,000 inhabitants, and is divided into 102 parishes: required the number of persons in each parish at an average.

15. England and Wales are estimated to contain 57231 square miles, 10150615 inhabitants: how many persons, at an average, on each mile?

16. A garrison have 157½ sacks of corn, and they consume daily 7 sacks and a half: how long will their store last?

17. How much hay must be allowed for a horse each day, in order that 6720 stones may last 128 horses three weeks?

18. The extent of Scotland is computed to be 27793 square miles, and the population at 1805688: required the number of inhabitants each mile contains.

19. A general commanded an army of 36000 men, which he increased one-third by recruiting; afterwards he lost one-eighth by disease and desertion, and one-fifth of the remainder fell in battle: how many men has he left?

20. The earth revolves round the sun in 365 days 6 hours 9 min. describing an orbit of 744457824 miles: how many miles does it move in a minute?

CASE II. TO DIVIDE COMPOUND NUMBERS.

RULE 1. *When the dividend consists of different denominations, divide the highest, and what is over reduce to the next lower name,* *adding the number of that name in the dividend; divide this sum as before, and so on till the last.*

Note. The same directions apply here as in integers, with regard to the divisor being either below or above 12, or a composite number.

EXAMPLES.

1. Divide £254„12„10½ by 27.

```
27)254„12„10½(9„8„7½
   243
   ---
    11
    20
   ---
   232     By component parts.
   216      or
   ---
    16   27 { 9|254„12„10½
    12      { 3| 28„ 4„10½
   ---   Proof £9„ 8„ 7½
   202
   189
   ---
    13
     4
   ---
    54
```

2. Divide 138 cwt. 2 qr. 27 lb. by 41.

```
      Cwt. qr. lb.  Cwt. qr. lb.
   41)138„2„27     (3„1„15
      123
      ---
       15
        4
      ---
       62
       41
      ---
       21
       28
      ---
      615
      41
      ---
      205
      205
      ---
```

EXERCISES.

1. Divide £96„17„ 6 by 2
2. .... 715„ 6„ 8¼ by 3
3. .... 40„13„ 4 by 5
4. .... 9„18„ 4 by 7
5. .... 100„10„ 0 by 9
6. .... 8„16„ 8 by 12
7. .... 360„ 4„10 by 17
8. .... 182„10„ 0 by 19
9. .... 234„ 3„ 9 by 20
10. ....3076„14„ 4½ by 35
11. Divide £250„15„ 6 by 41
12. .... 135„ 4„ 2 by 60
13. .... 418„13„ 2¾ by 65
14. .... 113„ 8„ 0 by 72
15. .... 931„19„ 9 by 87
16. .... 18„ 6„ 0 by 96
17. .... 102„10„ 6¾ by 109
18. .... 63„14„ 0 by 112
19. .... 103„14„ 2¼ by 231
20. .... 1050„10„ 0 by 120

21. Divide £125„10„ 6 by 7, 9, and 12.
24. .... 1600„ 6„ 8 by 13, 19, 26, and 170.
28. .... 950„18„ 4 by 18, 36, 73, and 144.

¶ 32. Divide 110 lb. 6 oz. 15 dwt. by 8.
33. .... 32 lb. 15 oz. 1 dwt. by 13.
34. .... 322 stones 6 lb. by 42.
35. .... 1109 Cwt. 3 qrs. 20 lb. by 81.
36. .... 2050 yds. 1 foot 6 inches by 54.
37. .... 1094 acres 2 ro. 20 perches by 63.
38. .... 3168 miles 30 poles by 98.
39. .... 294 years 146 days by 73.
40. Divide 1260 Cwt. 1 qr. 14 lb. by 11, 29, 50, and 75.
44. .... 1000 yds. 3 qrs. 2 na. by 8, 14, 20, 38, and 150.
49. .... 115 qrs. 6 bus. 2 pecks by 6, 17, 40, and 110.
53. .... 118 years 310 da. 18 hours by 4, 28, 56, and 112.

Rule 2. *When the divisor is in several denominations, reduce both divisor and dividend into the same name, and proceed as in division of integers.*

Note. It is best not to reduce the divisor and dividend *lower* than is necessary to make them equal. In the following example the terms are reduced only to *three-pences*, as each of them consists of an equal number.

EXAMPLES.

1. Divide £229„16„ 9 by £8„10„ 3.

8„10„ 3)229„16„ 9	Cwt. qr. lb.
20 20	3„ 1„ 15)227„ 1„26
170 4596	4 4
4 (3d.) 4	13 1109
681)18387(27 Ansr.	28 28
1362	109 8878
4767	27 2220
4767	379)31078(82 Ansr.

EXERCISES.

1. Divide £210„ 7„ 6 by £4„ 2„ 6
2. .... 147„10„ 0 by 5„18„ 0
3. .... 13403„19„ 4 by 35„ 7„ 4
4. .... 1055„15„ 6 by 25„ 2„ 9
5. .... 182„10„ 9 by 8„11„ 7
6. .... 902„ 0„ 0 by 9„ 7„11
7. .... 42„10„ 0 by 0„17„ 8½
8. .... 318„ 5„ 6¾ by 6„15„ 5¼

¶ 9. Divide 364 Cwt. 1 qr. 7 lb. by 3 Cwt. 2 qrs. 14 lb.

10. .... 45 tons 4 Cwt. 3 qrs. 14 lb. by 3 Cwt. 2 qrs. 7 lb.

11. .... 162 acres 36 perches by 5 acres 3 ro. 7 perches.

12. .... 975 miles 3 fur. 24 po. by 17 m. 8 fur. 14 po.

APPLICATION OF DIVISION.

The use of Division is to find either of the factors by whose multiplication a given number is produced, when the other factor is given; and therefore is of two kinds, since either the multiplier or the multiplicand may be given. If the former be given, it discovers what that number is which is contained so many times in another. If the latter be given, it discovers how many times one number is contained in another. Thus it answers the questions of an opposite kind in multiplication, when applied according to the following directions: —

First, *To find the quantity of a single parcel or share, divide the amount by the number of parcels or shares: Or to find the number of parcels, divide the amount by the quantity of a single one.*

EXERCISES.

1. At a public dinner, where there were 36 gentlemen dined, their bill came to 20 guineas: how much did each pay?

2. The bill for a public dinner came to 20 guineas, and each gentleman paid 11/8: required how many dined.

3. The capital of a Commercial House amounts to £40,000, and is divided into 120 shares: what does a single share amount to?

4. A quantity of tea, consisting of 38 parcels of equal weight, contains 332 lbs. 8 oz.: required the quantity of a single parcel.

5. How many parcels of 3½ lb. each can be made of an Cwt. of tea?

Secondly, *To find the value, weight, or measure of one article; divide the value, weight, or measure of the whole, by the number of articles: Or to find the number of articles, divide the value, weight, or measure of the whole by that of a single article.*

EXERCISES.

6. What cost a yard of printed cloth, when a piece of 28 yards was bought for three half-guineas?

7. What is the average weight of a bale of cotton, when 40 weigh 52 Cwt. 3 qrs. 12 lb.?

8. If 50 pieces of cloth measure 1437 yards 2 qrs. what is the length of one piece?

9. How many chests will be required to hold 41 Cwt. 2 qrs. 14lb. of tea, each to contain 1 Cwt. 14 lb.?

10. How many guineas, each weighing 5 dwt. 9 grs. may be coined from a lump of gold, weight 5 lb. 4 oz. 10 dwt.?

Thirdly, *To find how much work is done, provisions consumed, interest incurred, or the like, in a single day, or other portion of time; divide the work, consumption, or interest, by the number of days: Or to find the time, divide the whole amount by the daily allowance.*

EXERCISES.

11. If 180 Rods 270 feet of brick-work be done by 30 men in six weeks, how much work was done ℘ week, and by each man?

12. How many reapers will cut down a field of corn, measuring 12 acres 2 roods 30 perches, allowing each to reap 2 roods 18 perches a day?

13. If 45 Cwt. of ship-biscuit be consumed by 48 men in 20 weeks, how much was allowed each man ℘ month, ℘ week, and ℘ day?

14. How many weeks will 2559 hhds. 20 gals. 2 pts. of beer serve a garrison of 1350 men, allowing each 1½ pint ℘ day?

15. A sum of money draws yearly £250.18.9 of interest: how much does it amount to each calendar month, and ℘ day?

16. In what time will the interest of a Sum which yields £91.15 yearly, amount to £730?

Fourthly, *To find how many of a higher denomination are contained in a given number of a lower; divide the lower by as many as make one of the higher.*

This case is a kind of reduction exactly opposite to the fourth variety in Multiplication, and the one may be proved by the other.

EXAMPLES.

1. Find how many pence, shillings, and pounds in 148731 farthings.

4 | 148731 far.
12 | 37182$\frac{3}{4}$ pence
2,0 | 3098„ 6 shillings
£ 154„ 8„ 6$\frac{3}{4}$ *Answ.*

2. How many Cwt. in 7760 lb.

28 { 4 | 7660
7 | 1915
4 | 273„16
Answ. 68 Cwt. 1 qr. 16 lb.

EXERCISES.

17. How many pounds in 4532769 farthings ?
18. How many in 525873 halfpence ?
19. How many in 1689000 pence ?
20. How many in 3166546 two-pences ?
21. How many in 98760 three-pences ?
22. How many in 126090 four-pences ?
23. How many in 54325 sixpences ?
24. How many in 18181 shillings ?
25. How many in 80915 half-crowns ?
26. How many guineas in 22428 halfpence ?
27. How many lbs. in 56050 grains of gold ?
28. How many lbs. in 45000 dwts. of silver ?
29. How many lbs. avoirdupois in 24960 drams ?
30. How many lbs. in 132160 ounces ?
31. How many stones in 48790 lbs. ?
32. How many Cwts. in 15780 stones of 14 lb. each ?
33. How many yards of cloth in 10596 half-nails ?
34. How many English ells in 21692 nails ?
35. How many yards in 6865400 barleycorns ?
36. How many poles in 180360 inches ?
37. How many furlongs in 17056 feet ?
38. How many miles in 62700 yards ?
39. How many acres in 36590 square yards ?
40. How many leagues in 98650 furlongs ?
41. How many acres of land in 32196 square perches ?
42. How many wine-gallons in 740355 cubic inches ?
43. How many gallons of wine in 89616 pints ?
44. How many hhds. and tuns in 56740 gallons ?
45. How many ale gallons in 1100646 cubic inches ?
46. How many barrels in 98765 pints of ale ?
47. How many corn-bushels in 924500 cubic inches ?
48. How many quarters of wheat in 136840 pecks ?
49. How many hours and days in 8409600 minutes ?
50. How many days and years in 9465740 hours ?

PROMISCUOUS EXERCISES.

1. How much does sugar cost per lb. at 21/. ℘ qr. of an Cwt. ?
2. How much does tea cost ℘ lb. @ £25„4 ℘ Cwt.
3. How much does flour cost ℘ stone, @ 5 guineas ℘ sack ?

4. How much does butcher-meat cost ℘ lb. @ 7/7 ℘ stone?

5. How much does wine cost ℘ bottle, @ 47/6 ℘ dozen?

6. How much does beer cost ℘ dozen, @ 90/. ℘ gross?

7. How much does ale cost ℘ quart, at £9. ℘ barrel?

8. How long can a person board for £15., @ 12/6 ℘ week?

9. How much can a person spend ℘ week, out of a salary of £80 ℘ annum?

10. What quantity of hops will £100 purchase, at 15¾d. ℘ lb.?

11. How much does butter cost ℘ lb. @ £6 ℘ Cwt.?

12. How much will a person receive who had $\frac{3}{16}$ of a ticket in the lottery, which was drawn a prize of £10,000?

13. How many candles did a box contain, which cost 2 guineas, at the rate of 10½d. ℘ lb.?

14. A gentleman purchased 50 dozen of port wine for 100 guineas; what does it stand him ℘ bottle?

15. How many bottles, each holding 1¾ pints, can be filled out of a hhd. of claret?

16. Bought at a public sale a quantity of cloths for £84„7„6, at the average price of 11/3 a yard: required the number of pieces, each measuring 25 yards?

17. Required the weight of a guinea, when 44½ are coined from a lb. of standard coin?

18. Required the value, at the mint price, of a grain of gold, when a lb. is worth £46„14„6?

19. A merchant's Books show that he has sold goods in one year to the amount of £22082„10: required the amount of his sales each month and ℘ day, at an average?

20. An estate of 630 acres 1 rood is let for £1543„10: how much does the rent come to ℘ acre?

21. Twenty-seven persons joined in purchasing a lottery ticket for 18 guineas, which turned out a *blank*. How much did each lose?

22. A mercer sold 70 yards silk, @ a guinea ℘ yard, and allowed a twentieth part for *Cash;* how much money did he receive?

23. If 337½ quarters wheat grow on 72 acres; how much does each acre produce; and how much land does it require to produce a quarter?

24. If the interest of the National debt amount to 41 millions, how much does it come to ℘ day, and ℘ minute?

25. A man had two sons, between whom he divided his fortune, £2985„10, giving to the eldest £590„15 more than to the youngest: how much had each?

26. The sum of 1000 guineas is to be divided among two persons, and A. is to receive a guinea for every pound which B. receives; how much more than B. does A. receive?

27. How many yards of linen cambric, at 16/3 a yard, may be bought for £39, and at what price ℘ yard should it be sold to gain £3„5?

28. A cargo of sugars, consisting of 329 casks, weighing net 4490 *Cwt. 3 qrs. 14 lb.*, was sold for £17346„13„4: required the average weight and price of each cask; and ℘ Cwt.?

29. A spirit-merchant bought a puncheon of rum containing 105 gallons, which, including the duties, cost him £79„12„6. He has drawn off 16 gallons for his own private use: how much should he charge the remainder ℘ gallon to recover the cost?

30. The sum of £1260 is to be divided betwixt a mother, son, and daughter; and the son to have three times as much as his mother, and the mother double of the daughter: required the share of each?

QUERIES.

1. What is Division?
2. What names are given to these numbers?
3. When the divisor is above 12, how do you divide?
4. How do you divide when the divisor is a composite number?
5. How do you divide when a fraction is annexed to the divisor?
6. How do you prove Division?
7. How do you divide compound numbers?
8. How do you find the quantity of a single parcel or share?
9. How do you find the value, weight, or measure of a single article?
10. How do you find how much work is done, provisions consumed, interest incurred, &c. in a single day, or any portion of time?
11. How do you find, how many of a higher denomination are contained in a given number of a lower?

REDUCTION.

Reduction is the application of Multiplication and Division, in reducing money, weights, and measures, from one denomination to another?

Rule. *By multiplication, reduce the given denomination to some lower one contained in that required; then, by division reduce it to the required denomination.*

EXAMPLES.

1. Reduce 1260 guineas to pounds.
1260
21 shil.
1260
2520
20)26460 shil.
Answ. 1323 pounds.

2. Reduce 1809 half-guineas to seven-shilling pieces.
1809
21 sixp.=10/6
1809
3618
sixp. { 2 | 37989 sixpences.
7/=14 { 7 | 18994—1
2713 ps. and 3/6 over.

Note. The operation may be often shortened by adding or subtracting a certain part of the given number.

In Ex. 1. As guineas are $\frac{1}{20}$th part greater than pounds, we have only to add $\frac{1}{20}$ to the given number. — In Ex. 2. As three seven-shilling pieces are equal to two half-guineas, multiply by 3 and divide by 2, or add $\frac{1}{2}$. Thus in the above examples.

Ex. 1. $\frac{1}{20}$)1260 guineas.	Ex. 2. 1809 or, $\frac{1}{2}$)1809
add 63	3 904$\frac{1}{2}$
Ans. 1323 pounds.	2|5427 2713$\frac{1}{2}$
	Ans. 2713$\frac{1}{2}$

CONTRACTIONS.

To reduce guineas to pounds, add $\frac{1}{20}$.
.... pounds to guineas, sub. $\frac{1}{21}$.
.... half-guineas to seven-shilling pieces, add $\frac{1}{2}$.
.... seven-shilling pieces to half-guineas, sub. $\frac{1}{3}$.
.... crowns to 4/6 dollars, add $\frac{1}{9}$.
.... dollars to crowns, sub. $\frac{1}{10}$.
.... English ells to yards, add $\frac{1}{4}$.
.... yards to ells, subtract $\frac{1}{5}$.
.... puncheons to hogsheads, add $\frac{1}{3}$.
.... hogsheads to puncheons, sub. $\frac{1}{4}$.

EXERCISES.

1. How many guineas in 37254 pounds?
2. How many pounds in 8870 guineas?
3. How many crowns in 5095 guineas?
4. How many guineas in 8763 crowns?
5. How many pounds in 3040 dollars?
6. How many dollars in 1818 pounds?
7. How many crowns in 1620 dollars?
8. How many dollars in 2025 crowns?
9. How many seven-shilling pieces in 5427 half-guineas?
10. How many half-guineas in 9045 seven-shilling pieces?
11. How many three-shilling tokens in 3375 half-crowns?
12. How many half-crowns in 4050 three-shilling tokens?
13. How many pounds in 18146 three-shilling tokens?
14. How many pounds in 76540 one-shil.-and-sixp. tokens?

¶ 15. How many lbs. Troy in 4320 lbs. Avoirdupois?
16. How many lbs. Avoirdupois in 3045 lbs. Troy?
17. How many English ells in 4320 yards?
18. How many yards in 3375 English ells?
19. How many Imperial gallons in 3327 ale-gallons old measure?
20. How many wine-gallons in 4620 Imperial gallons?
21. How many puncheons of spirits in 1072 hhds.?
22. How many hogsheads of spirits in 1608 puncheons?
23. How many new gallons will fill a wine pipe, old measures?
24. How many Imperial bushels in 4436 Winchester bushels?
25. How many Winchester bushels in 6450 Imperial bushels?

26. How many Beer hhds. are equal in content to 186 wine hhds.?

¶ 27. How many British guineas are equal to £291„4 Irish, when in Ireland a guinea passes for 22/9?

28. A debt of £385 was discharged with an equal number of guineas, half-guineas, and seven-shilling pieces: required the number?

29. Required the difference in Troy weight, between a guinea which weighs 5 dwt. 9 grs., and a penny piece which weighs 1 oz. Avoirdupois?

30. Required the difference in Avoirdupois weight, between 1000 guineas, and the value of that sum in penny pieces?

31. Required the difference in gallons between the content of 39 wine tuns, and 87 beer butts?

32. How many shares of 3 lb. 4 lb. 6 lb. and 7 lb., of each a like number, in a quarter of beef weighing 12 stone 12 lbs.?

33. How many bottles of 6 quarterns each, will hold 24 casks of brandy, each containing 30 quarts?

34. A hogshead of Port wine is to be drawn off into bottles of 5, 6, and 7 quarterns; how many bottles will there be of an equal number of each?

35. What is the amount in Sterling money of 600000 gold chequins, each 8/10$\frac{5}{16}$: which sum Hassen Bey, the noted pirate, offered for his life?

PROMISCUOUS EXERCISES IN THE PRECEDING RULES.

1. A bankrupt owes A. £313„7„3, whose dividend amounts to £147„14„11½; to B. £290„4„6, who receives £136„16„9¼; to C. £700, who receives £330„0„10; to D. £486„13„8, who receives £229„9„3¾; to E. £500, who receives £235„14„10½; and to F. £381„10, who receives £179„17„5¼: how much will each creditor lose, and what is the amount of the bankrupt's deficiency?

2. A jockey went to Doncaster races, where he gained a prize of 100 guineas, but on another day, lost by betting against A. £50, and won from B. 30 guineas, lost by C. £20, won from D. 40 guineas, and from E. 70: he recovered a debt of £95„10, and paid a bill of £120„15„6: his expenses amounted to £17„14„9, and on reckoning his cash, when he came home, he found £230„10„6 still in his pocket? required how much money he had when he set out?

3. How many lbs. of cotton wool at 2/1½ ℘ lb. can be purchased for £135„18„9; and how may it be sold ℘ lb. to gain £18„2„6 by the sale?

4. The expense of manufacturing a Web of 100 ells was £12„13„4, and measured 15 dozen and 4 napkins: required the prime cost of an ell, of a napkin, and of a dozen?

5. A smuggler buys 128 lbs. tea, @ 5/. ℘ lb., but meets with an excise-officer, who seized 32 lbs. of it: how much must he charge a lb. of the remainder to lose nothing?

6. Ten persons joined in the purchase of a lot of muslin contain-

ing 130 yards, which cost £22.9.7: how much of the cloth and price belongs to each?

7. A spring of water, affording 7½ gallons each minute, supplies 3600 families: how much water may each family have daily?

8. The planet Mercury revolves 148 times round the sun in 35 years 242 days 20 hours: required the period of one revolution?

9. A log of timber weighs 25 Cwt. 3 qrs.; allowing each cubic foot to weigh 42 lbs.; what is the cubic measure of the whole?

10. If an acre of land produces 4½ qrs. wheat, and each peck give 20 lbs. of bread; how much land will supply 4800 families for a year, each family using 12 lbs. ⅌ day?

11. How much land will supply the population of London in bread which is estimated at 1,050,000, allowing each person 1½ lb. each day?

12. The time between observing the fire from a cannon, and hearing the report, was half a minute: required the distance, when sound moves forward 1142 feet in a second?

13. How long is the interval between seeing the fire, and hearing the report of a gun, discharged at the distance of 6 miles and a half?

14. After observing a flash of lightning, it was 10 seconds before the thunder was heard: required the distance of the cloud whence it came?

15. If an estate of 1252 acres 2 ro. 12 perches be let equally to 19 farmers, and ground equal to half the size of a farm be reserved for a fox-covert: how much land would each farmer occupy?

16. How long will a person be in walking from London to Richmond, a distance of 10 miles, when he takes 108 steps of 2½ feet every minute?

17. How many steps of 2½ feet each, must a person take in a minute to walk at the rate of 3 miles an hour?

18. At what rate ⅌ hour is a person travelling, who takes 140 steps, of 2½ feet every minute?

19. How long would the mail coach, (supposing the wheels to measure 6 yds. 2 ft. in circuit, and to turn 30 times ⅌ minute,) be in running from Carlisle to Glasgow, the distance being 102 miles?

20. If the mail coach leave Glasgow on Monday at 3 o'clock afternoon, when will a passenger arrive at Carlisle at the above rate of travelling?

21. King Solomon's annual revenue was 666 talents of gold, each weighing 114 lbs. 15 dwts. Troy: how much Sterling would this amount to, valuing the bullion at 3/10½ ⅌ dwt.?

22. How much money would purchase an acre of land, at as many half-pence as would cover one-eighth of it, allowing a square inch to every half-penny?

23. How long would a person take to count 36127080, the number of shillings of the new coinage, which lately issued from the mint, supposing him to reckon 100 shillings in a minute without intermission?

24. A person bought a hogshead of porter, which, including the

expense of carriage, cost 3 guineas; when bottled, it produced 23½ dozens, which he retailed at 4/6 ⅌ dozen: required his gain?

25. A gentleman's estate, renting £450, was sold at 25 years' purchase, and the money divided among his three sons as follows: — A. was to have ⅓; of the remainder B. was to have £1500 more than C.: required the share of each?

26. A father who had three sons leaves them £1600. His will specifies that the eldest son shall have £200 more than the second, and that the second is to have £100 more than the youngest: required the share of each?

27. A traveller has £147 in local notes, which he wishes to exchange for Bank of England notes, of one pound, and guineas, half-guineas, and seven-shilling pieces, of each an equal number: how many of each should he receive?

28. A butcher purchases at a cattle-market, cows at £8„10 a piece, bulls at 7 guineas, heifers at £6„12, and steers at 5 guineas: how many of each kind will he get for 350 guineas, and how many of an equal number of each?

29. Divide £13800 among a family of six sons, four daughters, two step-sons, and a step-daughter, giving a son twice as much as a daughter, a daughter twice as much as a step-son, and a step-son twice as much as a step-daughter?

30. A general, who commanded an army of 10800 men, detached 1200 of his men to take possession of a strong post, and ⅔ of the remainder to watch the motions of the enemy: how many men has he left?

31. A gentleman who had five daughters, left his eldest £1000 more than the youngest, and to the three next he left £6000 to be equally divided among them, which was equal to the sum the youngest and eldest had together. Required the fortune of each?

32. The following is the number of pieces of the new coinage issued lately from the mint, and paid into the bank, viz. 17899200 sixpences, 36127080 shillings, and 3934656 half-crowns: how many pounds do these pieces amount to?

33. A person purchased in 1816 a close near Derby, for which he paid in *hard cash* as follows: —

73 guineas
153 half-guineas
147 seven-shilling pieces
11 dollars @ 4/6
202 three-shilling pieces
26 half-crowns
22 one-shill.-and-sixp. pieces
234 shillings, and
26 sixpences:

required the amount of the purchase?

34. A merchant left his widow £900, to each of his three sons £751„6„8, to each of his six daughters £500„3„4, to each of ten poor relations £30, and to a public charity he bequeathed £145. He had been 18 years in trade, and had cleared £300 a-year at an average; required his original capital?

35. An estate, which sold for £17800„16„9, is to be divided among a family of 11 children; 4 sons and 7 daughters, after allowing ½ of the whole to the mother for an annuity. The eldest son

is to get ½ more than each of his brothers, and each daughter ⅓ less than each of their younger brothers: required the share of each?

36. Required to divide a prize of £3375.9 (after having allowed to his majesty ⅛ of the whole) among the crew of a privateer as follows: — 10 shares to the captain, to his first mate 6, and to the second 4, to the surgeon 8, to the carpenter 6, and 1 share to each of 146 sailors?

37. A person has three fields; the *first* measures 4 acres 20 perches, the *second* 3 acres 2 roods 12 perches, and the *third* 2 acres and a half. He intends to sell them off for building ground in lots of 300 square yards each: how many shares are contained in these fields, and what is the value at 7/6 ℔ square yard?

38. The capital or joint stock of the Bank of Philadelphia amounts to ten millions of dollars, and is divided in 25,000 shares: required the sum of each share in dollars, and the value in sterling money, both of the capital and of each share, the value of a dollar being 4/6?

39. A tract of land in America, measuring 7495 acres 3 roods 32 perches, is to be divided among a regiment consisting of a colonel, a major, 5 captains, 9 lieutenants, 6 ensigns, 20 serjeants, and 450 private soldiers; so that a serjeant is to have twice as much as a private, an ensign 8 shares, a lieutenant 12, a captain 20, the major 30, and the colonel 50: required the share of each, and the value of the land at 3 dollars ℔ acre?

SIMPLE PROPORTION.

SIMPLE PROPORTION teaches to find a fourth number in proportion to three given numbers.

This Rule, from the three numbers given, is frequently called the RULE OF THREE; and, from its extensive utility, sometimes the GOLDEN RULE.

RULE 1st. *Write down that term which is of the same kind with the answer.*

2d. *On the right of it place that term of which the price, weight, measure, or duration is required; and on the left, the remaining term of the same name.*

3d. *Consider, from the nature of the question*, whether the answer will be greater or less than the middle term.*

4th. *If the answer will be greater, multiply the middle term by the greater of the other two terms, and divide by the less; but if the answer will be less, multiply by the less term, and divide by the greater.*

Note. When the terms are in more denominations than one, if the compound multiplications and divisions can be conveniently performed, it is best to do so. If not, reduce the middle term to the lowest denomination, and the first and third to the same name. The quotient gives the answer in that name to which the middle term was reduced.

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* The learner should carefully read the question, and observe the *circumstance* upon which the proportion depends. It is evident *that the value,* weight, and measure of any commodity, is pro-

Example 1st. If 4 men reap 8 acres of barley; how many acres will 6 men reap in the same time?

Men. Acres. Men.
If 4 : 8 :: 6
6
4|48
Answer, 12 acres.

Here, as the answer is to be acres, the number of *acres* given is placed as the middle term. On the right of it we place 6 men, being the term which implies the demand; and on the left the remaining term. Then, as 6 men will reap more than 4 men, the answer will be greater than the middle term, we multiply it by 6, the greater number, and divide by 4, the less.

Example 2d. If 4 men reap a field of barley in 12 days; how long will 6 men take to do it?

Men. Days. Men.
If 4 : 12 :: 6
4
6|48
Answer, 8 days.

In this question, because *time* is required, we place 12, the given number of days, for the middle term; and as the answer will be less than the middle term, for it is obvious that 6 men will do any piece of work in less time than 4 men, we multiply by 4, the less number, and divide by 6, the greater.

To Abridge the Terms.

When the question is stated, if any of the terms which are to be multiplied together, and the term by which you divide can be measured by any number, divide them by that number, and use the quotients instead of the original terms.

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portioned to its quantity; that the amount of work or consumption is proportioned to the time; that gain, loss, or interest, when the time and rate are fixed, is proportioned to the capital sum from which it arises; and that the effect produced by any cause is proportioned to the extent of the cause. In these, and many other cases, the proportion is *direct;* and the number *required*, or *answer*, increases or diminishes along with the term from which it is derived. *Vide* Ex. 1st.

But in some questions, the *number required* becomes less, when the circumstance from which it is derived becomes greater. Thus, when the price of goods increases, the quantity which may be bought for a given sum is smaller. When the number of men employed at work is increased, the time in which they may complete it becomes shorter; and, when the activity of any cause is increased, the quantity necessary to produce a given effect is diminished. In these, and the like, the proportion is said to be *inverse*. *Vide* Ex. 2d and 3d.

Example 3d. If 21 men build a garden wall in 42 days, working 10 hours a day; in what time will 28 do the same?

Men. Days. Men.
If 21 : 42 :: 28
3 3 4
4|126
Answer, 31½ days.

To explain the method of abridging the terms, we must observe, that if two or more numbers be multiplied, or divided alike, the products or quotients will bear the same proportion to each other. Thus, in the above Example, the first and third terms are abridged by 7; and the quotients 3, and 4, have the same proportion as 21 has to 28.

It may also be observed, that in the question, a fourth term is introduced, *viz.* the *length of the day*, 10 hours; but this circumstance is unconnected with the proportion, for the 28 men are supposed to work the *same number of hours* each day, and for this reason we take no notice of it in stating the question.

The foregoing Rule for stating Questions, by making the first and third terms to bear the *same name*, is almost universally adopted by teachers; but some think, that the following is more conformable to the principles of analogy and the doctrine of Proportion.

Rule 1st. *Place that term for the third, which is of the same name with the answer, and consider whether the answer will be greater or less.*

2d. *If greater, place the least of the other terms for the first; but if the answer will be less, place the greatest for the first.*

3d. *Multiply the second and third terms together, and divide the product by the first, for the answer.*

The above question is stated thus:

Men. Men. Days.
As 28 : 21 :: 42
4 3 3
4|126
Answer, 31½da.

Here we consider that 28 men will take less time than 21 men to do any piece of work, and therefore will put 28, the greater number, for the first term, and 21, the less, for the second term. Before working the question we abridge the terms.

Note. The method of proving Questions in this Rule is by changing the order of the stating as in the first four of the following

EXERCISES.

1. If a piece of printed cloth of 28 yards cost £3.15, what will 21 yards of it cost?
2. If 21 yards of cloth cost £3.5, what cost a piece of 28 yards?
3. If 28 yards of cloth cost £3.15, how many yards will £3.5 purchase?
4. *If 21 yards* cost £3.5, how many yards may be bought for *£3.15?*

5. What cost 1932 gallons of port-wine, at £65„10 ⅌ pipe of 138 gallons?

6. Find the cost of 885 gallons of olive oil, at £68„15 ⅌ tun of 236 gallons.

7. If the excise duty on a tun of port wine be £44„10, what does it amount to on 1281 gallons?

8. Required the duty on 80 bales of cotton, weighing net 165 Cwt. 2 qrs. 19 lb. @ 16/8 ⅌ 100 lb.?

9. If a pack of English wool cost 20 guineas, what cost 10 packs 9 stones 12 lbs. at that rate?

10. How much will 3 casks Spanish madder cost, weighing net 30 Cwt. 3 qrs. 7 lbs. at 77/6 ⅌ Cwt.?

11. Required the value of 6 tons 4 Cwt. 3 qrs. 21 lbs. Riga hemp, at £67„10 ⅌ ton?

12. How much will a lot of wool cost which weighs 123 Cwt. 2 qrs. 16 lb. @ 47/6 ⅌ todd of 30 lbs.?

13. Bought at a sale a piece of superfine cloth measuring 28 yards for 20 guineas: how much should I charge a friend for 10½ yards of it?

14. If hay cost £3„10 ⅌ 100 stones, how much will 1275 stones cost?

15. If oats cost 37/6 ⅌ quarter, how much will 136 quarters 5 bushels 2 pecks cost?

16. How many yards of Holland may be bought for 50 guineas, at the rate of 5/3 ⅌ ell?

17. Purchased at a sale a hogshead of sugar, weighing net 15 Cwt. 1 qr. 17 lb. for £52„10: how much does it cost me ⅌ Cwt.?

18. If a grocer gain 1/9 on a lb. of tea which cost 8/4, how much will he gain on £100 value?

19. If 7 bushels of oats serve 8 horses for 6 weeks, how many horses will consume 343 bushels?

20. The valued rents of a parish is £5070„16„8, and the assessment for the poor-rates £405„13„4: how much will it come to on £45„12„9 at the same rate?

¶ 21. How many reapers must be employed to cut down a field of barley in a week which 6 persons can reap in 10 days?

22. If 4 carpenters take 12 days to lay 48 squares of flooring, how long should 9 men be in doing the same?

23. If 30 men can perform a piece of work in 25 days, how many men will do it in 10 days?

24. In how days many will 12 men do a piece of work which 30 men can do in 21 days?

25. If 32 yards of carpeting, yard-broad, cover a floor, how many yards 3 qrs. broad will cover the same?

26. How many yards of paper, 2 qrs. 1 nail broad, will line a room 28 yards round, and 3 high?

27. How many yards of print, 5 qrs. broad, will it require for curtains to a bed, when it took 54 yards of cloth 3 qrs. broad?

28. How many yards of paper, which is 2 feet in breadth, will hang a room 6 yds. long, 5¼ broad, and 8¼ feet high?

29. A garrison of 860 men have provisions for 270 days: how long will those provisions last if the garrison be reduced to 645 men?

30. If the garrison of a besieged place have provision for 12 weeks, at the rate of 18 ounces ℘ day for each man, what must be the allowance if they intend to hold out 16 weeks?

31.. How much money, at 4 ℘ Cent., will produce as much interest as £1475 at 5 ℘ Cent.?

32. How many days must £700 be lent to yield as much interest as £280 for a year?

33. How long ought A. to accommodate B. with the loan of £450, who lent A. £300 for 270 days?

34. How many yards of muslin at 2/6, are equal in value to 150 yards of printed cloth @ 3/4 a yard?

35. How much congou tea at 6/8 ℘ lb. should be given in exchange for 140 lb. bohea @ 8/4?

36. If 100 dozen strong beer, @ 5/3 ℘ dozen, be given in barter for 150 dozen porter: what was the porter valued at ℘ dozen?

¶ 37. A. has a pipe of wine containing 130 gallons, which cost £87„10, and he wishes to give B. 50 gallons of it at prime cost: how much should he charge?

38. If 3 persons among 100 die annually in London, how many burials will there be in a year, estimating the number of inhabitants at 1050000?

39. In the mint, 1 lb. of gold, including 1 oz. of alloy, is coined into 44½ guineas: how much is a lb. of pure gold worth at that rate?

40. A person travelling 16 hours a-day, performs a journey in 27 days: in what time will he do it, travelling at the rate of 12 hours a-day?

41. If a person drink 20 pints of wine when it cost 16/ a gallon, how much may he drink without increasing the expence when wine is at 20/?

42. How much water must be mixed with double rum which cost a guinea ℘ gallon, to fill up a cask of 100 gallons, so as to reduce the price to 17/6?

43. How much water must be mixed with 100 gallons of double rum at 21/ to reduce the price of a gallon to 17/6?

44. If an acre of land be 4 perches broad, and 40 long, how much of a ridge 9 perches broad will measure an acre?

45. A gentleman has an income of £730 a year: how much will he save the first six calendar months, allowing him to spend guinea at an average each day?

46. Nine carpenters are employed to finish a house in 3 weeks, but after they had wrought 9 days, five of them were sent to another job: how long will the rest take to finish the house?

47. To oblige a friend I lent him £250 for 90 days, without interest; on the 4th of May he lent me £300: how long should I *retain it* to be indemnified?

48. If a quantity of corn grow on 40 acres, when the seed yields

9 returns ⅌ acre: how much ground will produce as much, when the seed yields 12 returns?

49. A farmer had his crop cut down last year by 15 reapers in 3 weeks: how many reapers must he engage this season to cut it down in 14 days?

50. How much should a person pay for board and lodging for the first three calendar months of the year, at the rate of one guinea ⅌ week?

51. A superannuated officer has a pension of £400 a-year: how much is due to him from the 24th of March till the 29th of September?

52. A farm produced last year 360 quarters of wheat, which was sold at £4„8 ⅌ qr.; this year being plentiful, the farmer expects 450 qrs.: at what price should he sell to bring the same money?

53. How much money is a person possessed of, the interest of which, at 4½ ⅌ Cent., amounts to 19 guineas every quarter?

54. If a sack of flour, which weighs 280 lb., produce 80 quartern loaves: how many loaves will a quarter of wheat produce, which weighs 336 lb. of flour?

55. A merchant's book-keeper was to have £146 a-year, but he and his master disagree, after being with him from 24th June till 23d December: how much of his salary is due?

56. When flour was at 70/ a sack, the quartern loaf sold for 13d., how much should it cost when flour rises to 84/.?

57. If a lb. of bread a-day be the allowance to a seaman, and if 14 lb. of flour yield 17 lb. 6 oz. of bread: how much flour will a ship's crew of 56 men consume in a year?

58. A traveller walks 24 miles a day, and after he had gone 84 miles, another follows him who travels at the rate of 32 miles a day: in what time will he overtake him?

59. In what time will a person travel from London to York, walking 9 hours a day, if it can be performed in 4½ days of 12 hours each?

60. How long will a horse be in going round a race-course at the rate of 25 miles an hour, when he has performed it in 7½ minutes, at the rate of 30 miles?

61. What should A. value his cloth in barter, when it is worth 15/9 a yard, to be equal to B., who rates his sugar @ 8d. ⅌ lb. which is worth only 7d.?

62. If single rum, at 15/. a gallon, bear three waters to 1, what must be given for double rum, which takes 5 waters to 1, and the quality of the punch equal to that of the former?

63. I am offered rum at 16/6 a gallon, which bears 3 waters to one in punch, or double rum @ 19/. which takes 4 waters to one: required which is the cheapest?

64. A. gave B. cloths @ 12/. a yard, worth only half-a-guinea, in exchange for English wool, value 17/6 ⅌ stone, at a guinea: who had the advantage, and how much?

65. If barley sell at 42/. ⅌ quarter, how much is that ⅌ Scots boll, when 74½ qrs. are equal to 100 bolls?

66. If muslin 7/8ths yard wide, cost 2/11 a yard; what should be charged for cloth of the same fabric 9/8ths yd. wide, and how many yards of the former will compensate 140 yards of the latter?

67. If the penny loaf weigh 7 oz. 14 drs. when wheat is at 7/6 a bushel, what did it weigh in 1800, a year of scarcity, when wheat rose to a guinea ℔ bushel?

68. A privateer, sailing at the rate of 10 miles an hour, discovers a ship 18 miles a head, making way at the rate of 8 miles an hour: required how long, and how many miles the ship will hold out, before the privateer come up to her?

69. The beam of a false balance measures 36½ inches, and 35 lb. hung on the one end will equiponderate 38 on the other: required the length of each arm of the beam?

70. A garrison of 1200 men has provisions for 12 months, but at the end of 2 months are reinforced with 300 men; and 2 months after that with 300 more: required how long the provisions will last, supposing no alteration in the daily allowance of each man?

QUERIES.

1. What does simple Proportion or the Rule of Three teach?
2. How are questions in this rule distinguished?
3. What is meant by *direct* proportion?
4. What is *inverse* proportion?
5. How do you state the question?
6. How do you work the question?
7. How do you abridge the terms?
8. How do you prove questions in this rule?

COMPOUND PROPORTION.

Compound Proportion has five, seven, or more terms given to find another in proportion to them.

Every question in this rule may be answered by two, three, or more statings of the simple rule, according as it consists of five, seven, or more terms; the answer of the former stating being always the middle term in the next; but instead of working such questions separately, it would answer the same purpose, and is generally better, to collect all the terms by which we multiply into one product, and the terms by which we divide it into another, according to the following rule.

TO STATE AND WORK THE QUESTION.

Rule 1. *Write down that term for the second or middle term, which is of the same name with the answer in the simple rule.*

2. *Take any two terms of the same name with each other, and consider whether more or less is required; if more, place the less for the first, and the greater for the third; but if less, the contrary.*

3. *Proceed in this manner with every remaining pair of like terms, and place them directly under the former.*

4. *Multiply the product of the third terms by the middle term for a dividend, and divide by the product of the first term. The quotient is the answer in the same manner as the middle term.*

EXAMPLES.

If 6 horses plough 15 acres of land in 2 weeks, how many acres will 14 horses plough in 5 weeks at the same rate of working?

Horses. Acres. Horses.
If 6 : 15 : : 14
weeks 2 70 5 weeks.
12)1050 70
Ans. 87 acres 2 roods.

Elucidation. Here both statings are *direct*. First, 14 horses will evidently plough more than 6. Secondly, more work will be done in 5 weeks than in 2; we therefore place the greater numbers (14 and 5) for the third terms, and the less numbers (6 and 2) for the first terms; we next multiply the third terms together, and their product by (15) the middle term, for a dividend, and the first terms together for a divisor.

2. If 15 men consume 39/. value of bread in 6 days, when wheat is at 24/. ℘ load, how many men will consume the value of £6„10 in bread in 12 days, when wheat falls to 20/.?

Shil. Men. Shil.
If 39 : 15 : : 130 = £6„10
12 days 6 days
20/. 24/.
9360 18720
15 men
936,0)28080,0(30 men. *Ansr.*
2808
0

Elucidation. Here the first stating is *direct*, for the larger the sum laid out on provisions, the more men will be required to consume them; but the second and third statings are *inverse*, for the longer the time is, fewer men will consume an equal value of provisions, and the cheaper provisions are, more men are necessary to consume the same value.

Note. Questions in this rule may be proved by Simple Proportion.*

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* The first example may be resolved into two questions in the simple rule, and stated as follows:—

1. If 6 horses plough 15 acres in a certain time, how many acres will 14 horses plough in the same time?

As 6 horses : 15 acres : : 14 horses.—Ansr. 35 acres.

EXERCISES.

1. If 9 carpenters in 12 days lay 36 squares of flooring, how many squares will 12 men lay in 10 days?

2. If 9 men in 12 days can lay 36 squares of flooring, how many men must be employed to 42 squares in 7 days?

3. If 9 men in 12 days lay 36 squares of flooring, how long will 12 men take to lay 42 squares?

4. If 25 reapers cut down a field of oats of 50 acres in a week, how many acres will 16 reapers reap in 14 days?

5. If 14 reapers cut down 21 acres of wheat in 6 days, how many reapers will cut down 150 acres in 10 days?

6. If 20 reapers cut down in 5 days 36 acres of corn, in what time will 50 reapers cut down 180 acres?

7. If the freight of a canal-boat of 30 tons burden for 7 months be £175, what ought to be paid for a vessel of 50 tons, for 4 months, at the same rate?

8. How long will £700, at 4 ℘ Cent., yield as much interest as £500 for 219 days, at 5 ℘ Cent.?

9. If 34 men perform a piece of work in 27 days, working 7 hours a day; in what time will 27 men do the same, when they work 17 hours a day?

10. If 260 stones, 15 inches by 10, pave 30 square yards; how many stones, 24 inches by 18, will pave 50 sq. yards?

11. If muslin ⅜ths yard wide cost 3/4 ℘ ell, what should be charged for 72 yards of cloth of the same fabric ⅞ths yard wide?

12. If the carriage of 120 stones of merchant goods from Leeds to Newcastle, a distance of 99 miles, cost £4.2.6; how much should be charged for goods, weighing 135 stones, from Leeds to Glasgow, a distance of 264 miles, at the same rate?

13. If the carriage of 150 feet of wood, which weighs 3 stone ℘ foot, for 40 miles, be £3.10; how much will the carriage of 54 feet of stone, which weighs 8 stone ℘ foot, come to for 25 miles?

14. If 30 bricklayers build a garden wall in 4 months, working 10 hours a day; how long will 40 take to build the same, working only 8 hours a day?

15. A garrison of 1500 men have provisions for 12 weeks, at the rate of 20 ounces ℘ day to each man; how many men will the same provisions maintain for 20 weeks, allowing each man only 8 ounces a day?

16. An undertaker contracted to make 240 yards of a road in 4 weeks, and for that purpose hired 30 men, but at the end of 8 days, he found he had executed only 60 yards; how many additional men must he employ to finish the work in the stipulated time?

17. If 15 lads of 18 years of age do a piece of work in 60 days;

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2. If in 2 weeks a certain number of horses plough 35 acres, how many acres will they plough in 5 weeks?

As 2 weeks : 35 acres : : 5 weeks.—Ansr. 87½ acres.

in what time will 9 men, 24 years old, do the same, supposing their strength to increase in the same proportion as their age?

18. If the expense of 9 horses for corn be £11„5, for 4½ months, when the price of oats is 36/8 ℘ qr.; how many horses will at that rate consume the value of £54, in 6 months, when oats sell at 32/.?

19. If 30 men in 40 hours dig 80 cubic yards; how many yards will 80 men, stronger in the proportion of 5 to 4, dig in 90 hours, supposing the ground in this case harder than the former, in the ratio of 9 to 8?

20. It was computed that 200 men would fortify a camp, with a ditch and rampart in 60 days, working 14 hours a day; but the general, fearing an attack from the enemy sooner than he expected, ordered 150 men more to be employed, and to work 16 hours a day after the others had wrought 14 days: in what time will the fortification be finished?

DISTRIBUTIVE PROPORTION.

THIS Rule, which is only an application of Simple Proportion, teaches to divide a sum into any proposed number of parts or shares, in proportion to several given sums.

RULE. *As the amount of the several sums is to the number to be divided; so is each particular sum to the respective proportion of it.*

EXAMPLES.

1. A premium of 200 guineas being given to encourage the cultivation of flax, was distributed among four persons, in proportion to the quantities they raised. A. raised 490 stones, B. 420, C. 350, and D. 270: how much will each receive?

	stones.	stones. : £. :: stones.			rem.
A. ………	490	1530 : 210 :: 490 :	A.'s	£67„ 5„ 1	… 270
B. ………	420	1530 : 210 :: 420 :	B.'s …	57„12„11	… 450
C. ………	350	1530 : 210 :: 350 :	C.'s …	48„ 0„ 9	… 630
D. ………	270	1530 : 210 :: 270 :	D.'s …	37„ 1„ 2	… 180
	1530			£210„ 0„ 0	

2. Three butchers pay £60 a season for a park: A. had 20 cows in for 3 months, and 12 for 4 months. B. had 15 cows in 2 months, and 50 for 3 months. C. had 12 cows in for a month, and 30 for 2 months: required how much each butcher should pay of the rent, according to the use he had of the park?

cows. mos.		
A. … 20 × 3 = 60	B. … 15 × 2 = 30	C. … 12 × 1 = 12
12 × 4 = 48	30 × 3 = 90	30 × 2 = 60
108	120	72

£.
108 + 120 + 72 = 300 : 60 :: 108 : £21„12„0 …… A. pays.
300 : 60 :: 120 : 24„ 0„0 …… B. Do.
300 : 60 :: 72 : 14„ 8„0 …… C. Do.
£60„ 0„0 Proof.

EXERCISES.

1. The amount of the legacies bequeathed in a will was £7350 but the net amount of the testator's property at his death was only £6520.10: how much will A. B. and C. receive, to whom he bequeathed £750, £575, and £400 respectively?

2. A gentleman bequeathed a piece of land, measuring 270 acres, to three old tenants, to be divided in proportion to their rent. Now A. pays £180 of rent, B. £120, and C. £60: required the share of each?

3. Four graziers hire a grass enclosure, for which they agree to pay £29.8. A. put in 28 cattle to graze for 35 days; B. 21 cattle for 28 days; C. 14 cattle for 35 days; and D. 7 cattle for 42 days: how much should each pay of the rent, in proportion to the number of cattle, and the time they grazed?

4. A general imposed a contribution of £1000 on four villages, to be paid in proportion to the number of inhabitants in each; the first contains 358 persons; the second 420; the third 630; and the fourth 720: required how much each village must pay, and how much it is to each person?

5. Three officers, A. with 36 men; B. with 27 men; and C. with 18 men, obtained a booty of 810 guineas: the officers are to have one-third of the whole which is to be divided among them, in proportion to the number of men each had. The remaining two-thirds is to be divided equally among the men: required the share of each officer, and of each private?

6. Two persons hired a chaise from Leeds to Manchester, which is 42 miles, for 2 guineas and a-half. At Huddersfield, which is 16 miles, they met with a gentleman of their acquaintance, who wished for a seat, and agreed to pay proportionally: required how much he ought to pay of the hire?

7. A nobleman at his death left £300 to his four servants, which he ordered to be divided among them in proportion to their wages, and the time they have served with him; his butler has been with him 12 years, at £40 a-year; his coachman 10 years, at £30; his footman 7 years, at £16; and his errand boy 5 years, at £6 a-year required the share of each?

8. A gentleman bequeathed to his eldest son £2000; to his second, £1600; to the third, £1200; to his eldest daughter, £1000; and to his youngest, £800. By subsequent misfortunes his whole estate at his death was worth only £4500; which, as his will had not been altered, his executors wished to divide among his children in the proportion which their father intended: required the share of each?

9. In a Public Concern, which is carried on with a capital of £40,000, a profit of £3500 is to be divided among the proprietors according to each partner's share: required the rate ⅌ Cent. of the profits, and how much A. B. will receive, who has three £50 shares, *and two* £100 shares?

PRACTICE.

THIS rule teaches to calculate in a short and expeditious manner the value of goods: hence it is usually called Practice.

Here, we suppose the price of each article to be a *penny*, a *shilling*, or a *pound*, as is most convenient; accordingly, the number of articles will be the value in *pence*, *shillings*, or *pounds;* we divide the number of articles by the aliquot part, or parts of the supposed price, which are contained in the real price, and the quotient, or sum of the quotients, is the answer.

TABLE OF ALIQUOT OR EVEN PARTS.

Of a Penny.		
$\frac{1}{4}$d.	is	$\frac{1}{4}$
$\frac{1}{2}$	is	$\frac{1}{2}$

Of a Shilling.		
1d.	is	$\frac{1}{12}$
$1\frac{1}{2}$	is	$\frac{1}{8}$
2	is	$\frac{1}{6}$
3	is	$\frac{1}{4}$
4	is	$\frac{1}{3}$
6	is	$\frac{1}{2}$

Of a lb. Troy.		
6 oz.	is	$\frac{1}{2}$
4	is	$\frac{1}{3}$
3	is	$\frac{1}{4}$
2	is	$\frac{1}{6}$
1 oz. 10dwt.		$\frac{1}{8}$
1	is	$\frac{1}{12}$

Of an oz. Troy.		
10 dwt.	is	$\frac{1}{2}$
6 dwt. 16 grs.		$\frac{1}{3}$
5	is	$\frac{1}{4}$
4	is	$\frac{1}{5}$
3 dwt. 8 grs.		$\frac{1}{6}$
2 dwt. 12 grs.		$\frac{1}{8}$
2	is	$\frac{1}{10}$
1 dwt. 16 grs.		$\frac{1}{12}$

Of a Pound.		
1d.	is	$\frac{1}{240}$
$1\frac{1}{2}$	is	$\frac{1}{160}$
2	is	$\frac{1}{120}$
3	is	$\frac{1}{80}$
$3\frac{3}{4}$	is	$\frac{1}{64}$
4	is	$\frac{1}{60}$
5	is	$\frac{1}{48}$
6	is	$\frac{1}{40}$
$7\frac{1}{2}$	is	$\frac{1}{32}$
8	is	$\frac{1}{30}$
10	is	$\frac{1}{24}$

Of a Ton.		
10 cwt.	is	$\frac{1}{2}$
5	is	$\frac{1}{4}$
4	is	$\frac{1}{5}$
2 cwt. 2 qrs.		$\frac{1}{8}$
2	is	$\frac{1}{10}$
1 cwt. 1 qr.		$\frac{1}{16}$
1	is	$\frac{1}{20}$

Of a Cwt.		
2 qrs.	is	$\frac{1}{2}$
1	is	$\frac{1}{4}$
16 lb.	is	$\frac{1}{7}$
14	is	$\frac{1}{8}$
8	is	$\frac{1}{14}$
7	is	$\frac{1}{16}$

Of a Pound.		
1/.	is	$\frac{1}{20}$
1/3	is	$\frac{1}{16}$
1/4	is	$\frac{1}{15}$
1/8	is	$\frac{1}{12}$
2/.	is	$\frac{1}{10}$
2/6	is	$\frac{1}{8}$
3/4	is	$\frac{1}{6}$
4/.	is	$\frac{1}{5}$
5/.	is	$\frac{1}{4}$
6/8	is	$\frac{1}{3}$
10/.	is	$\frac{1}{2}$

Of a Cwt.		
$3\frac{1}{2}$ lb.	is	$\frac{1}{32}$
2	is	$\frac{1}{56}$
$1\frac{3}{4}$	is	$\frac{1}{64}$

Of a Quarter.		
14lb.	is	$\frac{1}{2}$
7	is	$\frac{1}{4}$
4	is	$\frac{1}{7}$
$3\frac{1}{2}$	is	$\frac{1}{8}$
2	is	$\frac{1}{14}$

Of a lb. Avoir.		
8 oz.	is	$\frac{1}{2}$
4	is	$\frac{1}{4}$
2	is	$\frac{1}{8}$
1	is	$\frac{1}{16}$

CASE I. WHEN THE PRICE IS AN ALIQUOT PART OF A PENNY, OF A SHILLING, OR OF A POUND.

RULE. *Divide the number of articles by that aliquot part, and the quotient is the answer, in that name of which the price is an aliquot part: which if pence or shillings, reduce to pounds.*

EXAMPLES.

Calculate 1983 articles, @ ½d., 3d., and 2/6.

½	1983 at ½d.	¼	1983 at 3d.	⅛	1983 at 2/6
$\frac{1}{12}$	991½	$\frac{1}{20}$	495„9		£247„17„6
20	82„7		£ 24„15„9		
	£ 4„2„7½				

ELUCIDATION. In calculating for ½d. we divide by 2, which gives pence, and reduce those pence to pounds by dividing by 12 and 20: for 3d. we divide by 4, which gives shillings, because four three pences are a shilling, and by 20 for pounds. As 3d is $\frac{1}{80}$ part of a pound, we might have divided by 80; the quotient gives pounds, and what was over would have been so many three pences. For 2/6 we divide by ⅛, because 2/6 is one eighth of a pound, and the 7 of a remainder is 7 half crowns, or 17/6.

EXERCISES.

1 Calculate 9876 articles at ¼d., ½d., 1d. 1½d.
2. .... 8765 articles at 2d. 3d. 4d. 6d.
3. .... 7654 articles at 8d. 10d. 1/. 1/8. 2/.
4. .... 6543 articles at 2/6. 3/4. 4/. 5/. 6/8. 10/.

CASE II. WHEN THE PRICE IS A SIMPLE NUMBER, AS PENCE OR SHILLINGS.

RULE. *Multiply the number of articles by the price; and the product gives the answer in the same name as the price, which, if pence or shillings, reduce to pounds.*

Or, divide the price into two or more aliquot parts; work for those as in the last Case, and add the products.

EXAMPLES.

Calculate the value of 9876 articles, @ 5d. each.

	Method 1.		Method 2.		Method 3.
	9876	4d.=⅓	9876	⅙, ¼	9876
	5	1d.=¼	3292		2469=3d.
12	49380 pen.		823		1646=2d.
2,0	411,5	2,0	411,5	$\frac{1}{20}$	411,5
	£ 205„15		£ 205„15		£ 205„15

Method 4.		Method 5.		Method 6.	
6d.=½	9876 @ 5d.	1/48 { 4	9876	6d.=1/40	9876
off 1d.=⅙	4938			off 1d.= ⅙	246„18
	823	12	2469		41„ 3
2,0	4115	£	205„15	£	205„15
£	205„15				

Note. 1st. When the price is an *even* number of *shillings* not exceeding 24, the answer may be found very expeditiously, by multiplying the quantity by half the price, and doubling the first figure of the product for shillings; the rest will be pounds.

2d. Though the price be not an even number of shillings, we may multiply by half the even number, and add 1/20 part of the quantity for the odd shilling.

Value 754 yards of cloth at 8/. and 11/. ⅌ yard.

754 @ 8/.		754	754 @ 11/.	1/20	754
8	or,	4	11	or,	5
2,0)603,2	£	301„12	2,0)829,4		377„ 0
£301„12			£414 „14		37„14
				£	414„14

CONTRACTIONS.

For 15/.	subtract	¼	For 19/.	subtract	1/20	For 24/.	add	⅕
16/.	....	⅕	21/.	add	1/20	25/.	....	¼
18/.	....	1/10	22/.	....	1/10	30/.	....	½

EXERCISES.

1. Calculate 16789 yards @ 5d., 7d., 9d., 10d., 11d.
2. .... 4596 yards @ 3/., 7/., 8/., 9/., 11/., 12/., 13/.
3. .... 3218 yards @ 14/., 15/., 16/., 17/., 18/., 19/.
4. .... 5673 yards @ 21/., 22/., 23/., 24/., 25/., 26/.
5. .... 2345 Cwt. @ 27/., 28/., 30/., 35/., 43/., 54/.
6. .... 1814 Cwt. @ 65/., 76/., 87/., 98/., 105/., 126/., 130/.

CASE III. WHEN THE PRICE IS A MIXED NUMBER, AS PENCE AND FARTHINGS.

RULE. *Multiply the number of articles by the highest name, and take parts for the lower ones; their sum will be the answer in the highest name, which reduce to pounds.*

Or, if the price be less than one pound, divide it into two or more aliquot parts, as in Case I.

EXAMPLES.

1. Value 4325 yards @ 7½d. a yard.

4325	6d.=½ | 4325	1/32 { 8 | 4325
7½	1½d.=¼ | 2162„6	4 | 540„12„6
30275	540„7½	£ 135„ 3„1½
2162½	2,0 | 2703„1½	
12 | 32437½	£ 135„3„1½	
2,0 | 2703„1½		
£ 135„3„1½		

2. Value 435 yards of cloth @ 7/10½ a yard.

435	6/8 } ⅓ | 435	or, ⅛ | 435
7	1/. } 1/20 | 145„ 0„ 0	8
10½d.=⅛ | 3045	2d. ⅙ | 21„15„ 0	3480
380„7½	½d. 4 | 3„12„ 6	off 54„4½
1/20 | 3425„7½	0„18„ 1½	2,0)342,5„7½
£ 171„5„7½	£ 171„ 5„ 7½	£171„5„7½

CONTRACTIONS.

For 13/4 sub.	⅓	For 19/4 sub.	1/30	For 21/8 add	1/12
16/8	⅙	19/6	1/40	22/6	⅛
17/6	⅛	19/8	1/60	23/4	⅙
18/4	1/12	19/9	1/80	26/8	⅓

EXERCISES.

1. Calculate 12345 lb. @ 1¼d., 1¾d., 2¼d., 2½d., 2¾d., 3¼d.
2. .... 9876 lb. @ 3½d., 3¾d., 4¼d., 4½d., 4¾d., 5¼d.
3. .... 8765 lb. @ 5½d., 5¾d., 6¼d., 6½d., 6¾d., 7¼d.
4. .... 7654 lb. @ 7½d., 7¾d., 8¼d., 8½d., 8¾d., 9¼d.
5. .... 6543 lb. @ 9½d., 9¾d., 10¼d., 10½d., 10¾d., 11¼d.
6. .... 5432 lb. @ 11½d., 11¾d., 12¼d., 12½d., 12¾d., 13¼d.
7. .... 4321 lb. @ 13½d., 13¾d., 14¼d., 14½d., 14¾d., 15¼d.
8. .... 3219 lb. @ 1/3½, 1/4, 1/7½, 1/9, 1/10½, 2/1.
9. .... 2109 lb. @ 2/3, 2/5, 2/9¾, 3/3, 3/8, 4/6.
10. .... 1817 lb. @ 5/10, 6/4, 7/10½, 8/9, 9/4, 10/10.
11. .... 1650 lb. @ 11/8, 12/6, 13/4, 14/8, 15/10, 16/8.
12. .... 1208 lb. @ 17/6, 18/4, 19/4, 19/6, 19/8, 19/9.
13. .... 2107 Cwt. @ 20/6, 21/8, 22/6, 23/4, 25/10, 26/8.
14. .... 1123 Cwt. @ 27/6, 28/4, 29/9, 31/6, 33/4, 37/6.

15. .... 1050 Cwt. @ 41/8, 42/6, 56/8, 67/6, 78/9, 87/3.
16. .... 950 Cwt. @ 89/3, 92/6, 93/4, 96/8, 108/4.

CASE IV. WHEN THERE IS A DIFFICULT FRACTION IN THE PRICE.

RULE. *Multiply the price by the under-figure of the fraction, adding the upper, and take parts for the price thus multiplied; divide the result by the under-figure of the fraction for the answer.*

EXAMPLES.

1. What is the expense of weaving 525 ells muslin @ 5$\frac{5}{8}$d.?

5$\frac{5}{8}$
*8
45d.=3/9

2/6=$\frac{1}{8}$	525
1/3=$\frac{1}{2}$	65„12„6
	32„16„3
*8	98„ 8„9
	£ 12„ 6„1$\frac{1}{8}$

or,	525
	5$\frac{5}{8}$
	2625
	328$\frac{1}{8}$
12	2953$\frac{1}{8}$
2,0	246„1
	£ 12„6„1$\frac{1}{8}$

4d.=$\frac{1}{3}$	525
1d.=$\frac{1}{4}$	175
	43„9
2,0	218„9
add 8	10„18„9
	1„ 7„4$\frac{1}{8}$
	£ 12„ 6„1$\frac{1}{8}$

ELUCIDATION. In the first method we multiply the price 5$\frac{5}{8}$d. by 8, which gives 45d. or 3/9; we calculate for this as if it was the real price, and divide the result by 8, the figure by which we multiplied the price. In the next method we multiply by 5$\frac{5}{8}$ in the manner explained in Division, Rule 4. p. 49.; the product is pence, which we reduce to pounds: and in the third method we multiply the aliquot parts of a shilling for 5, and add $\frac{1}{8}$ of the value at 5d. for $\frac{5}{8}$.

2. Calculate 1050 yards Osnaburghs @ 6$\frac{2}{3}$d.

6$\frac{2}{3}$d.
3*
20d. or 1/8

1/8=$\frac{1}{12}$	1050
*3	87„10
	£ 29„3„4

or, 2	1050 sixp.
$\frac{2}{3}$=$\frac{1}{9}$	525
	58„4
2,0	583„4
	£ 29„3„4

$\frac{1}{40}$	1053
$\frac{1}{9}$	26„ 5
	2„18„4
	£ 29„ 3„4

EXERCISES.

1. Calculate 8760 yards @ 1$\frac{2}{3}$d., 2$\frac{1}{3}$d., 3$\frac{2}{3}$d., 4$\frac{1}{3}$d., 5$\frac{2}{3}$d.
2. .... 7895 yards @ 6$\frac{1}{3}$d., 7$\frac{1}{6}$d., 8$\frac{5}{6}$d., 9$\frac{1}{8}$d., 10$\frac{3}{8}$d.
3. .... 5472 yards @ 11$\frac{5}{8}$d., 12$\frac{7}{8}$d., 13$\frac{1}{12}$d., 14$\frac{5}{12}$d.
4. .... 4321 yards @ 15$\frac{7}{12}$d., 16$\frac{11}{12}$d., 17$\frac{1}{16}$d., 18$\frac{3}{16}$d.
5. .... 1990 yards @ 1/7$\frac{5}{16}$, 2/10$\frac{7}{16}$, 3/4$\frac{9}{16}$, 4/3$\frac{13}{16}$.

CASE V. WHEN THERE IS A FRACTION ANNEXED TO THE NUMBER OF ARTICLES.

RULE. *Calculate as before, and add a proportional part of the price to the result for the fraction in the quantity.*

Or, annex to the quantity such a part of a pound as the fraction is of an unit, then take parts of the price as before.

EXAMPLE.

Value $542\frac{7}{8}$ yards of cloth @ 16/8.

10/. } $\frac{1}{2}$ 6/8 } $\frac{1}{3}$	542
	271
	180„13„ 4
$\frac{1}{2}$ yd. or $\frac{4}{8}$	8„ 4
$\frac{1}{4}$ yd. or $\frac{2}{8}$	4„ 2
$\frac{1}{8}$	2„ 1
£	452„ 7„11

$\frac{1}{3}$, $\frac{1}{2}$	542„17„ 6
	271„ 8„ 9
	180„19„ 2
£	452„ 7„11

$\frac{1}{6}$	542„17„ 6 = 20/.
off	90„ 9„ 7 = 3/4
£	452„ 7„11

ELUCIDATION. In the first of these methods, after taking parts for 16/8, the price, we take the half of 16/8 for $\frac{1}{2}$, or $\frac{4}{8}$ of a yard, the half of $\frac{4}{8}$ for $\frac{2}{8}$ of a yard, and the half of $\frac{2}{8}$ for $\frac{1}{8}$ of a yard, for the price of $\frac{7}{8}$ of a yard. In the two other methods, we annex to the quantity 17/6, being $\frac{7}{8}$ths of a pound, and then calculate as before.

EXERCISES.

1. Calculate $987\frac{1}{4}$ yards @ 1/10, 2/8, 3/10, 4/8.
2. .... $876\frac{1}{2}$ yards @ 5/3, 6/6, 7/9, 8/10.
3. .... $765\frac{3}{4}$ yards @ 9/3, 10/6, 11/9, 12/11.
4. .... $612\frac{1}{8}$ yards @ 13/9, 14/3, 15/6, 16/10.
5. .... $549\frac{3}{8}$ yards @ 17/8, 18/9, 19/2, 20/8.
6. .... $430\frac{5}{8}$ yards a 21/3, 22/4, 23/8, 24/6.
7. .... $328\frac{7}{8}$ yards @ 25/4, 26/8, 27/10, 28/3.
8. .... $485\frac{5}{12}$ yards @ 29/10, 30/6, 31/3, 32/8.
9. .... $219\frac{7}{12}$ yards @ 33/9, 34/2, 35/7, 36/6.
10. .... $360\frac{11}{12}$ yards @ 37/3, 38/4, 39/3, 40/10.
11. .... $430\frac{7}{16}$ yards @ 41/8, 42/6, 43/4, 44/3.
12. .... $235\frac{9}{16}$ yards @ 45/10, 46/8, 54/2, 55/10.

CASE VI. WHEN THE QUANTITY CONSISTS OF SEVERAL DENOMINATIONS.

RULE. *Multiply the price by the highest denomination, and take parts of the price for the lower denominations: their sum is the answer in the same name with the price.*

EXAMPLES.

1. Value 145 Cwt. 3 qrs. 7 lbs. sugar @ 78/4.

Method 1.		Method 2.		
	145.3.7		£3.18. 4	
2 qrs. ... ½)	78/4		12×12	
	1160		47. 0. 0	
	1015		12	
	48. 4		564. 0. 0	= 144 cwt.
1 qr. ... ½)	39. 2	½	3.18. 4	= 1 do.
7 lb. ... ¼)	19. 7	½	1.19. 2	= 2 qrs.
	4.10¾	¼	0.19. 7	= 1 qr.
	20)11421.11¾		0. 4.10¾	= 7 lb.
Ans.	£ 571.1.11¾		£ 571. 1 11¾	as before.

Elucidation. In Method 1. we multiply the number of Cwts. by the price in *shillings*, viz. 78, and take ⅓ part of 145 for the 4d., being one-third of a shilling; next we take aliquot parts of 78/4, the price for 3 qrs. 7 lbs.: the sum of the quotients gives the answer in shillings, &c. which we reduce to pounds. In Method 2. we multiply the price of one Cwt. by the given number of Cwts. as in Compound Multiplication, and take proportional parts for the 3 qrs. 7 lbs.

2. Value 15 Tons 12 Cwt. 2 qrs. 14 lbs. logwood at £11.10 ꝑ ton.

10 cwt. ... ½)	£11.10.0 ꝑ ton.	
	3×5	
	34.10.0	
	5	
	172.10.0	= 15 tons.
¼	5.15.0	= 10 cwt.
1/20	1. 8.9	= 2 cwt. 2 qrs.
	0. 1.5¼	= 14 lb.
£	179.15.2¼	Answer.

3. Value 134 Oz. 16 dwt. 20 grains gold at 77/6 ꝑ oz.

	oz. dwt. gr.	
6d. ... ½)	134.16.20	
	77/6	
	938	
	938	
	67	
10 dwt. ... ½)	38. 9	
6 dwt. 16 grs. ... ⅓)	25.10	
	7¾	
2,0)	10450. 2¼	
£	522.10.2¼	Answer.

1. At £1 ⅌ Cwt. the value of a quarter is 5/, of 14 lb. 2/6, and of 7 lb. 1/3; therefore in *Example* 1st,

$\frac{1}{12}$)£145„16„ 3 = value at £1 ⅌ cwt.
4£
583„ 5„ 0 = value at 80/.
12„ 3„ 0¼ = value at 1/8.
Answer £571„ 1„11¾ = value at 78/4, *as before.*

2. At £ 1 ⅌ Ton, a Cwt. is 1/., a qr. 3d., and 7 lb. ¾d.; therefore in *Example* 2d,

½)£15„12„ 7½ the value at £1 per ton.
11£
175„18„10½ value at £11 ⅌ ton.
7„16„ 3¾ value at 10/. ⅌ do.
Answer £179„15„ 2¼ value at £11„10, *as before.*

3. At £1 ⅌ Oz. a dwt. is 1/. and a grain ½d.; therefore in *Example* 3d,

⅛) £134„16„10 the value at £1 ⅌ oz.
4£
539„ 7„ 4 value at 80/.
off 16„17„ 1¼ value at 2/6.
Answer £522„10„ 2¾ value at 77/6, *as before.*

EXERCISES.

1. Calculate 12 Cwt. 1 qr. 7 lb. @ 17/6, 23/4, 35/9 ⅌ cwt.
2. .... 18 Cwt. 2 qrs. 14 lb. @ 46/8, 52/6, 65/. ⅌ cwt.
3. .... 27 Cwt. 3 qrs. 21 lb. @ 67/6, 70/. 75/. ⅌ cwt.
4. .... 39 Cwt. 1 qr. 16 lb. @ 77/6, 78/4, 79/6 ⅌ cwt.
5. .... 45 Cwt. 2 qrs. 24 lb. @ 84/., 86/8, 87/6 ⅌ cwt.
6. .... 76 Cwt. 3 qrs. 10 lb. @ 88/., 90/., 93/4 ⅌ cwt.
7. .... 87 Cwt. 21 lb. @ 95/., 96/8, 97/6 ⅌ cwt.
8. .... 198 Cwt. 1 qr. 19 lb. @ 98/4, 99/., 105/. ⅌ cwt.
9. .... 45 tons 6 cwt. 2 qrs. @ £25„10, £36„15 ⅌ ton.
10. .... 132 tons 16 cwt. 3 qrs. 21 lb. @ £43„6„8, £67„10„6 ⅌ ton.
11. .... 121 oz. 17 dwt. 16 gr. @ 5/6, 6/8, 78/4, 84/., 87/9 ⅌ oz.
12. .... 185 qrs. 5 bus. 2 pecks @ 32/6, 43/4, 68/., 77/6 ⅌ qr.
13. .... 79 acres 1 ro. 25 per. @ 63/., 71/6, 75/., 82/6, 90/. ⅌ acre.

QUERIES.

1. What is Practice?
2. How do you calculate the value of any number of articles, when the price is an aliquot part of a shilling or of a pound?
3. How do you know the value of *remainders* in dividing by aliquot parts?
4. How do you calculate, when the price is a *simple number*, as *pence or shillings*, but not an aliquot part?

5. How do you calculate, when the price is *shillings* and *lower denominations*?

6. How do you calculate, when there is a *difficult fraction* in the price?

7. How do you calculate, when there is a *fraction* in the quantity?

8. How do you calculate, when the quantity is in *several denominations*?

Practical Abbreviations.

I. To find the value of a dozen of articles, reckon a shilling for every penny in the price:

Thus, 12 lbs. loaf sugar @ 13d. is 13 shillings.
12 lbs. coffee .... @ 2/3 is 27 shillings.

EXERCISES.

1. Value 12 lbs. candle @ 11d.
2. .... 12 lbs. soap ... @ 10½d.
3. .... 12 lbs. coffee @ 1/5
4. .... 12 yds. muslin @ 2/9
5. Value 12 lbs. @ 15½d.
6. .... 12 lbs. @ 18d.
7. .... 12 lbs. @ 19½d.
8. .... 12 lbs. @ 3/8

II. To find the price of a single article, at a certain rate ꝑ dozen; reckon a penny for every shilling in the rate:

Thus, one article @ 3/9 ꝑ dozen costs 3¾d.; and 13 articles @ 3 9 ꝑ dozen is 3/9 and 3¾d., or 4/0¾.

EXERCISES.

Find the cost of the following articles:—

13 articles @ 2/6 ꝑ dozen.
11 .... @ 3/. ... .
10 .... @ 3/3 ... .
14 .... @ 3/6 ... .
15 .... @ 3/9 ... .
18 .... @ 4/. ... .
9 .... @ 4/3 ... .
9 articles @ 4/6 ꝑ dozen.
7 .... @ 5/. ... .
11 .... @ 5/3 ... .
16 .... @ 6/. ... .
8 .... @ 7/9 ... .
18 .... @ 8/. ... .
10 .... @ 9/6 ... .

If shawl cloths sell at 17/6 ꝑ dozen, how much is a single one?
What are handkerchiefs a-piece, at 34/. ꝑ dozen?
If corks cost 4/6 ꝑ gross, how much is that ꝑ dozen?

III. To find the price of a single article, at a certain rate ꝑ score; reckon a shilling for every pound in the price:

Thus, if 20 quires paper cost £2„10, a single quire costs 2/6.

EXERCISES.

.. If 20 articles cost £2„5, what costs one?
2. If 20 .... cost £3„10, what costs one?
3. If 20 .... cost £4„15, what costs one?
4. If 20 cwt. or a ton cost £18„13„4, what costs one Cwt.?
5. If a ream of paper cost £3„7„6, what is the price of a quire?
6. What is the discount on £32„6„8, at 1/. ꝑ pound?
7. What is the interest on £56„15, at 1/. ꝑ pound?

IV. To find the value of a Cwt., or 112lb., at so much ℘ lb.; reckon as many times 9/4, as there are pence in the price, for the answer.

Note. If there be an odd ¼d. in the price, add 2/4, if ½d., add 4/8, and if ¾d., add 7/.:

Thus, a Cwt. of soap at 9d. ℘ lb. is 9/4 × 9 or 84/. ℘ cwt.

Or, for every farthing which the price contains, reckon twice as many shillings, and once as many fourpences.

Ex. Value 112lbs. sugar, at 8¾d.

Is 9/4 × 8 = 74/8
add for ¾d. 7/.
81/8

or, 35 farthings is 70/.
35 fourpen. 11/8
81/8

EXERCISES.

1. 112 lb. @ 7d.
2. 112 lb. @ 8d.
3. 112 lb. @ 9d.
4. 156 lb. @ 10d.
5. 1 Cwt. @ 9½d.
6. 1 Cwt. @ 10¼
7. 1 Cwt. @ 11¾
8. 1 Cwt. @ 12½
9. 1 Cwt. @ 7½d.
10. 1½ Cwt. @ 8¼d.
11. 2 Cwt. @ 9¾d.
12. 3 Cwt. @ 10½d.

V. To find the price of a single lb. at so much ℘ Cwt.; multiply the price of the Cwt. in shillings by 3, and divide the product by 7. The quotient will be the price of one lb. in farthings.

Ex. 1. At 29/. ℘ Cwt. what is that ℘ lb.
42 sh.
3
7)126
18 far. or 4½d. ℘ lb.

Ex. 2. At 65/4 ℘ Cwt. what cost a lb.
65 „ 4
3
7)196
28 far. or 7d. ℘ lb.

EXERCISES.

What costs a lb.?

1. At 35/. ℘ Cwt.
2. ... 37/4 ℘ Cwt.
3. ... 46/. ℘ Cwt.
4. At 63/. ℘ Cwt.
5. ... 70/. ℘ Cwt.
6. ... 74/8 ℘ Cwt.
7. At 77/4 ℘ Cwt.
8. ... 80/8 ℘ Cwt.
9. ... 84/. ℘ Cwt.

VI. To find the value of 240 articles; reckon a pound for every penny in the price, and every farthing, if any, 5/.

Or divide the price in farthings by 4 (mentally); the quotient is the answer in pounds; every unit over is 5/.

Ex. What cost 240 lb. refined sugar at 12½d., 13¾d., 14¾d.?
At 12¼d. is £12„5; at 13½d. is £13„10; at 14¾d. is £14„15.
Or 49 far. ÷ 4 = £12„5; or 54 far. is £13„10; or 59 far. is £14„15.

EXERCISES.

1. Value 240 lb. @ 7½d.
2. .... 240 lb. @ 9¼d.
3. .... 240 lb. @ 10½d.
4. .... 240 lb. @ 11¾d.
5. .... 240 lb. @ 15d.
6. Value 240 lb. @ 17½d.
7. .... 240 lb. @ 21d.
8. .... 360 lb. @ 2/6
9. .... 480 lb. @ 3/4
10. .... 120 lb. @ 6/8

VII. To find the value of 120, (the long hundred, or six score,) reckon 10/. for every penny in the price, and every farthing 2/6.

Or, divide the farthings contained in the price by 8, the quotient is the answer in pounds.

Ex. What cost 120 lb. candles @ 8¾d. ?

Thus 8d. is 80/
¾ or three 2/6, 7„6
Answ. 87/6 or £4„7„6

or, 8) 35 far. = 8¾
£4„7„6

EXERCISES.

1. Value 120 lbs. @ 6¼d.
2. .... 120 lbs. @ 9½d.
3. .... 120 lbs. @ 10¾d.
4. .... 120 lbs. @ 13d.
5. Value 120 lbs. @ 14½d.
6. .... 360 lbs. @ 16¼d.
7. .... 480 lbs. @ 19½d.
8. .... 60 lbs. @ 5/2

VIII. To find the value of 100, or 5 score.

1st. If the price be shillings, multiply by 5 for the answer in pounds.
Thus 100 lbs. tea at 9/. is 5 times 9, or £45.

2d. If the price be pence, divide the former value by 9.
Thus 100 lbs. soap @ 9d. is 45÷9, or £3„15.

Or, 3d. If pence and farthings; for every farthing in the price, reckon as many pence and twice as many shillings ?

Ex. What cost 100 yards ribbon @ 5d., 5¼d., and 5¾d. a yard ?

5d. = 20 far. = 40/.
and 20d. = 1/8
41/8

21 far. = 42/.
21d. = 1/9
43/9

23 far. 46/.
pen. 1/11
47/11

EXERCISES.

Find the value of

1. 100 yards @ 9/.
2. 100 yards @ 11/.
3. 100 lbs. tea @ 7/.
4. 100 gals. rum @ 18/.
5. 100 gals. gin @ 23/.
6. 100 yards ribbon @ 3¾d.
7. 100 yards do. @ 4½d.
8. 200 yards linen @ 19d.
9. 300 yards muslin @ 2/10
10. 50 yards flannel @ 17½d.

IX. To find the value of 144, or a gross; to half the number of *pence* in the price considered as pounds, add ⅕th.

Or, multiply the price in pence by 3, and divide by 5, and for every odd farthing add 3/.

Ex. At 9d. each, what cost 144 articles ?

½ of 9 is £4„10
add ⅕ or 18
Ans. £5„ 8

or 9d. × 3 = 27 ÷ 5 = £5„8

EXERCISES.

What cost 144 articles, or 12 dozen, or great gross—

1. At 8d.
2. … 9½d.
3. … 10½d.
4. … 13d.
5. At 15½d.
6. .. 18d.
7. … 19½d.
8. … 20¼d.
9. At 22½d.
10. … 2/3
11. … 2/6
12. … 3/9

X. To find the value of 1000, for every farthing in the price, reckon as many pounds and as many tenpences.

Thus, 1000 lb. ⓐ 7½d. is £30„ 0
and 30 tenpences 1„10
Ans. £31„10

1000 lb. ⓐ 1¾d. is £7„0„ 0
7 tenpences 0„5„10
Ans. £7„5„10

EXERCISES.

1. 1000 lb. ⓐ 2½d.
2. 1000 lb. ⓐ 3¾d.
3. 1000 lb. ⓐ 5d.
4. 1000 lb. ⓐ 6½d.
5. 1000 lb. ⓐ 8¼d.
6. 1000 lb. ⓐ 10½d.
7. 1000 lb. ⓐ 11¼d.
8. 2000 lb. ⓐ 13d.
9. 500 lb. ⓐ 14d.

XI. To find the value of 1200, reckon as many pounds as there are farthings in the price, and as many 5/.

Or, to the number of farthings, add, and the sum will be pounds.

Ex. Thus, 1200 lb. ⓐ 6¾d. is £27„ 0
and 27 five shil. …… 6„10
£33„10

1200 lb. ⓐ 7½d. is £30„ 0
add ¼ or 7„10
£37„10

EXERCISES.

1. Cal. 1200 lb. ⓐ 8¼d.
2. …… 1200 lb. ⓐ 9¾d.
3. …… 1200 lb. ⓐ 10½d.
4. Cal. 2400 lb. ⓐ 11d.
5. …… 4800 lb. ⓐ 13½d.
6. …… 600 lb. ⓐ 21¼d.

12. To find the expense or income of a year, when that of one day is given. For every penny, reckon as many pounds, half-pounds, four-pences, and pence.

Thus at 13d. ℘ day.
13d. = £13„ 0„0
half is 6„10„0
13 { four pen. 0„ 4„4
13 { pence 0„ 1„1
£19„15„5

At 17½ ℘ day.
17½d. = £17„10„ 0
half 8„15„ 0
17½ { four pen. 0„ 5„10
17½ { pence 0„ 1„ 5½
£26„12„ 3½

EXERCISES.

1. A person saves 14d. each day: how much is that ℘ year?
2. A person spends 19½d. ℘ day: how much is that ℘ ann.?
3. If a person has 2/3¾ of income, one day with another: how *much does it amount* to in the year?

DEDUCTIONS ON WEIGHTS.

THE whole weight of any commodity, including that of the hogshead, cask, box, bag, or other package in which it is contained, is called the *Gross Weight.*

Draft is an allowance made, in order that the weight may not be deficient, and varies on different kinds of goods: on Cotton, it is 1 lb. ⅌ bag; on Madder, in London, 4 lb. ⅌ cask, &c.

Tare is the weight of the package, or allowance made for it.

Tret is an allowance on goods, on which there is waste or dust. It is usually 4 lb. ⅌ 104 lb.

Suttle is what remains after the *Tare* is deducted.

Net Weight is what remains after all deductions are made.*

CASE I. TO CALCULATE THE TARE.

RULE 1. *When Tare is at so much ⅌ Cwt. take aliquot parts of* 112.

2. *If the Tare be at so much ⅌ Cent. take aliquot parts of* 100.

EXAMPLES.

Ex. 1. Find the tare on 125 Cwt. 1 qr. 14 lb. @ 4 lb. ⅌ Cwt.

Cwt. qr. lb.
4 lb. = $\frac{1}{28}$) 125,, 1,, 14
Answ. 4,, 1,, $25\frac{1}{4}$

Ex. 2. Find the net weight on 24 bags of cotton, weighing 57 Cwt. 1 qr. 8 lb., tare 1 lb. ⅌ bag, tare $2\frac{1}{2}$ lb. ⅌ 100.

Cwt. qr. lb.
Gross 57,, 1,, 8
24 draft.
$2\frac{1}{2}$ lb. ⅌ 100 = $\frac{1}{40}$) 57,, 0,, 16
1,, 1,, 20
Answ. 55,, 2,, 20 lb. net.

Note. In computing the allowances for Tare and Tret, we may reject any fractions less than $\frac{1}{4}$ lb., and yet obtain an answer sufficiently exact in business; for the purchaser is usually allowed 1 lb. if the fraction over be equal to $\frac{1}{2}$ lb.

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* The allowance for *Cloff,* of 2 lb. on every 3 Cwt., is now seldom, if ever, given; and the term *Cloff,* in the few cases in which it exists as a separate allowance, has various meanings. On rice, it is allowed for damage or breaking of the grains. On molasses, it is allowed for the adhesion of part of the commodity to the cask. It is generally 2 lb. ⅌ hhd., ⅌ barrel, &c.

EXERCISES.

1. Find the tare on 750 Cwt. 1 qr. 11 lb., tare 2½ ℘ 100 lb.
2. …………… on 543 Cwt. 2 qr. 16 lb., tare 4 lb. ℘ 100.
3. …………… on 352 Cwt. 3 qr. 8 lb., tare 5 ℘ Cent.
4. …………… on 614 Cwt. 0 qr. 24 lb., tare 3½ lb. ℘ cwt.
5. …………… on 465 Cwt. 2 qr., tare 7 lb. ℘ ditto.
6. …………… on 292 Cwt. 2 qr. 14 lb., tare 8 lb. ℘ ditto.
7. …………… on 219 Cwt. 3 qr. 20 lb., tare 12 lb. ℘ ditto.
8. …………… on 198 Cwt. 0 qr. 8 lb., tare 14 lb. ℘ ditto.
9. …………… on 184 Cwt. 2 qr. 21 lb., tare 16 lb. ℘ ditto.

10. Required the cost of 6 chests of tea, weighing 6 Cwt. 1 qr. 11 lb., draft 1 lb., and tare 25 lb. ℘ chest, @ 4/6 ℘ lb. net.

¶ 11. Find the net weight of 40 hhds. tobacco, weighing 194 Cwt. 3 qr. 12 lb., tare 67 lb. ℘ hhd., and the cost at 7½d. ℘ lb.

12. Find the net weight of 72 bags of cotton, weighing 241 Cwt. 6 lb., draft 1 lb. ℘ bag, tare 4 lb. ℘ 100, and the value at 2/3 ℘ lb. net.

13. Compute the value of 12 bags of Spanish wool, weighing 25 Cwt. 2 qr. 19 lb., tare 20 lb. ℘ bag, @ 4/9 ℘ lb. net.

14. What cost 9 sheets of wool, weighing 15 packs 14 stones 8 lb., tare 8 lb. ℘ sheet, at 20 guineas ℘ pack?

15. What is the net weight and cost of 9 casks of madder, weighing 85 Cwt. 3 qr. 22 lb., draft 4 lb. ℘ cask, and tare 10 lb. ℘ cwt., @ 84/. ℘ cwt.?

16. Required the net weight and value of 130 barrels pot-ashes, weighing gross 331 Cwt. 3 qr. 12 lb., tare 14 lb. ℘ cwt., @ 43/6 ℘ cwt.?

CASE II. TO FIND THE TRET.

RULE. *Divide the suttle by 26, and the quotient is the tret.*

EXAMPLE.

Find the tret on 44 Cwt. 3 qrs. 7 lb. and the net.

$\frac{1}{26}$ | 44„3„7
1„2„25 tret.
Cwt. 43„0„10 net.

ELUCIDATION. As the given weight is supposed to be *suttle* (*i. e.* the weight after the tare is deducted), we have only to divide by 26 for the tret; this allowance being usually 4 lbs. on every 104 lb., which is 1 lb. on 26, or $\frac{1}{26}$th part.

EXERCISES.

1. Find the net weight and value of 10 bales pimento, weighing *each* 2 Cwt. 3 qrs. 15 lb., tare 2 lb. ℘ bale, tret 4 lb. ℘ 104, @ 1/8¼ *℘ lb. net?*

2. Find the net weight in lbs. of 8 chests of Jesuits' bark, weighing gross, 20 Cwt. 1 qr. 8 lb., tare 5 Cwt. 6 lbs., draft 2 lb. ⅌ chest, dust 3 ⅌ Cent., and tret as usual.

3. Find the value of 4 bales of goats' wool, weighing gross, 15 Cwt. 2 qrs. 1 lb., draft 2 lb. ⅌ bale, tare 4 lb. ⅌ Cwt., and the usual tret, @ 4/8 ⅌ lb. net.

4. Required the net weight of 10 barrels rice, weighing 28 Cwt. 1 qr. 18 lb., tare 5 cwt. 3 qrs., draft 2 lb. ⅌ barrel, and cloff 2 lb. ⅌ do.?

5. How much will 3 packs of wool cost, weighing 10 Cwt. 3 qrs. 6 lb., tare 30 lb. ⅌ pack, tret 8 lb. ⅌ 20 stones of 16 lb., @ 11/6 ⅌ stone, net?

VULGAR FRACTIONS.

A **Vulgar Fraction** is any part of an unit or integer, and is expressed by two numbers, as $\frac{3}{4}$, three-fourths.

A fraction consists of two parts, a numerator and denominator. The denominator shows into how many parts the unit, of which the fraction is a part, is divided; and the numerator, how many of these parts are expressed.*

Fractions are of three kinds: proper, improper, and compound fractions.

A *proper fraction* has its numerator less than its denominator, and is therefore less than unity, as $\frac{3}{4}$, $\frac{7}{8}$, &c.

An *improper fraction* has its numerator equal to, or greater than its denominator, and is therefore equal to, or greater than unity, as $\frac{4}{4}$, or $\frac{5}{4}$, &c.

A *compound fraction* is a fraction or part of another fraction, as $\frac{1}{2}$ of $\frac{3}{4}$.†

All fractions whose numerators and denominators are the same, as $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$, $\frac{8}{8}$, $\frac{12}{12}$, &c. are equal to unity, and also to one another.

All fractions whose numerators are greater than their denominators, $\frac{3}{2}$, $\frac{9}{8}$, $\frac{13}{12}$, &c. are greater than unity, for $\frac{3}{2}=1\frac{1}{2}$, $\frac{9}{8}=1\frac{1}{8}$, $\frac{13}{12}=1\frac{1}{12}$.

The value of a fraction is not altered, though both terms be multiplied by the same number, or divided by a number which measures both; because $\frac{2}{4}$ multiplied by 2 produces $\frac{4}{8}$; and if $\frac{4}{8}$

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* If we take the fraction $\frac{3}{4}$, the *denominator* 4 points out that the unit is divided into *four* equal parts; and the *numerator* 3, shows that *three* of these parts are to be taken as the value of the fraction.

† To explain this by an example: suppose A. has $\frac{3}{4}$ of a ship or of any other property, if I purchase $\frac{1}{2}$ of his share, then my share will be $\frac{1}{2}$ of $\frac{3}{4}$, which is $\frac{3}{8}$.

divided by their common measure 4, it gives $\frac{1}{2}$, which is equal in value to $\frac{2}{4}$ or $\frac{4}{8}$.

A *whole number* may be expressed in the form of a fraction, by placing 1 for its denominator; thus 5 may be expressed $\frac{5}{1}$.

QUERIES.

1. What is a vulgar fraction?
2. How many parts does a fraction consist of?
3. What do the denominator and numerator point out?
4. Explain this by an example?
5. How many kinds of fractions are there?
6. What is a proper fraction?
7. What is an improper fraction?
8. What is a compound fraction?
9. Explain this by an example?
10. When are fractions equal to unity?
11. When are fractions greater than unity?
12. Is the value of a fraction altered, if both terms be multiplied by the same number, or divided by a number which measures both?
13. How is a whole number expressed in the form of a fraction?

REDUCTION OF FRACTIONS.

CASE I. TO REDUCE MIXT NUMBERS TO IMPROPER FRACTIONS.

RULE. *Multiply the integer by the denominator of the fraction, and to the product add the numerator: under which, place the denominator.*

Ex. Reduce $3\frac{1}{4}$ to an improper fraction.

$3\times4=12+1=\frac{13}{4}$ Answer.

EXERCISES.

1. Reduce $5\frac{2}{3}$, $7\frac{3}{4}$, $8\frac{1}{2}$ to improper fractions.
2. .... $6\frac{4}{5}$, $9\frac{5}{8}$, $12\frac{7}{8}$ to improper fractions.
3. .... $17\frac{5}{12}$, $21\frac{9}{14}$, $132\frac{15}{16}$ to improper fractions.

CASE II. TO REDUCE IMPROPER FRACTIONS TO WHOLE OR MIXT NUMBERS.

RULE. *Divide the numerator by the denominator.*

Ex. Reduce $\frac{13}{4}$ to a whole or mixt number.

$13\div4=3\frac{1}{4}$ Answer.

EXERCISES.

1. Reduce $\frac{17}{3}$, $\frac{38}{5}$, $\frac{17}{2}$, to whole or mixt numbers.
2. .... $\frac{26}{7}$, $\frac{76}{4}$, $\frac{239}{11}$, to whole or mixt numbers.
3. .... $\frac{173}{6}$, $\frac{280}{8}$, $\frac{1175}{12}$, to whole or mixt numbers.

CASE III. TO REDUCE FRACTIONS TO THEIR LOWEST TERMS.

RULE. *Divide the greater term by the less, and the divisor by the remainder continually, till nothing remain. The last divisor is the greatest common measure; by which divide the numerator and denominator of the given fraction.*

Ex. Reduce $\frac{540}{612}$ to its lowest terms.

```
540)612(1
    540
    ---
     72)540(7      Then 540/612 ÷ 36 = 15/17 Answer.
        504
        ---
         36)72(2
            72
            --
```

ELUCIDATION. Here we first find the greatest common measure to the fraction $\frac{540}{612}$ which is 36; we then divide both numerator and denominator by it, and obtain $\frac{15}{17}$ the lowest possible terms. If in finding the common measure, the last divisor had been 1, the fraction is already in its lowest terms.

EXERCISES.

1. Reduce $\frac{20}{48}$, $\frac{64}{184}$, $\frac{204}{540}$, $\frac{290}{481}$, to their lowest terms.
2. .... $\frac{345}{600}$, $\frac{27}{954}$, $\frac{620}{864}$, $\frac{1080}{1728}$, to their lowest terms.

[CASE IV. TO REDUCE FRACTIONS TO A COMMON DENOMINATOR.

RULE. *Multiply both terms of each fraction by every denominator except its own.*

Or, *Find a number divisible by all the given denominators; multiply both terms of each fraction by the quotient divided by the denominator of the fractions respectively.*

Ex. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, to similar fractions.

$$\left.\begin{array}{l}\frac{1}{2}\times3\times4\times5\times6=\frac{360}{720}\\ \frac{2}{3}\times2\times4\times5\times6=\frac{480}{720}\\ \frac{3}{4}\times2\times3\times5\times6=\frac{540}{720}\\ \frac{4}{5}\times2\times3\times4\times6=\frac{576}{720}\\ \frac{5}{6}\times2\times3\times4\times5=\frac{600}{720}\end{array}\right\} \begin{array}{c}\text{or}\\ \text{or}\\ \div12=\\ \text{or}\\ \text{or}\end{array} \left.\begin{array}{l}\frac{30}{60}\text{ for }\frac{1}{2}\\ \frac{40}{60}\text{ for }\frac{2}{3}\\ \frac{45}{60}\text{ for }\frac{3}{4}\\ \frac{48}{60}\text{ for }\frac{4}{5}\\ \frac{50}{60}\text{ for }\frac{5}{6}\end{array}\right\}\text{Answers.}$$

REMARKS. If it be required to reduce a fraction to the lowest possible terms, the greatest common measure for this purpose will always be found by the above rule: but it is generally sufficient in practice to divide by such numbers as answer on inspection, to facilitate which we observe,

1. Any number whose unit's place is 2, 4, 6, 8, or 0, is measured by 2.
2. Any number whose unit's place is 5, or 0, is measured by 5.
3. Any number whose figures, when added, amount to an even number of 3's and 9's, is measured by 3 and 9 respectively.

Note. In the above Example, it will be readily seen, that 60 is the lowest number which will contain the several denominators an exact number of times: therefore we have only to take such a part of 60, as the fractions express: Thus,

$$60\left|\begin{array}{l}\frac{1}{2}\times\ 3=\frac{30}{60}\\ \frac{2}{3}\times 20=\frac{40}{60}\\ \frac{3}{4}\times 15=\frac{45}{60}\end{array}\right\}\text{Ansr.}\qquad \begin{array}{l}\text{And}\\ 60\left|\begin{array}{l}\frac{4}{5}\times 12=\frac{48}{60}\\ \frac{5}{6}\times 10=\frac{50}{60}\end{array}\right\}\text{Ansr.}\end{array}$$

EXERCISES.

1. Reduce $\frac{2}{3}$, $\frac{5}{6}$, $\frac{7}{10}$, to similar fractions.
2. ……… $\frac{3}{4}$, $\frac{2}{5}$, $\frac{9}{10}$, to similar fractions.
3. ……… $\frac{5}{6}$, $\frac{8}{9}$, $\frac{5}{12}$, to similar fractions.
4. ……… $\frac{3}{7}$, $\frac{9}{14}$, $\frac{11}{28}$, to similar fractions.
5. ……… $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{9}{16}$, to similar fractions.

CASE V. TO REDUCE COMPOUND FRACTIONS TO SIMPLE ONES.

RULE. *Multiply the numerators together for the numerator of the simple fraction, and the denominators for a denominator.*

Ex. 1. Reduce $\frac{1}{2}$ of $\frac{3}{4}$ to a simple fraction.
$\frac{1}{2}\times\frac{3}{4}=\frac{3}{8}$ Answer.

Note. 1. To shorten the operation, cancel or neglect such figures above and below the line, as are the same in both.

2. If part of the compound fraction be mixt, reduce it to an improper fraction; or if a whole number express it in the form of a fraction, by placing 1 under it as a denominator.

Ex. 2. Reduce $\frac{3}{4}$ of $3\frac{1}{3}$ of 4 to a simple fraction.
$3\frac{1}{3}=\frac{10}{2}$ and $4=\frac{4}{1}$. Then $\frac{3}{4}\times\frac{10}{3}\times\frac{4}{1}=\frac{10}{1}$ or 10 Answ.

EXERCISES.

1. Reduce $\frac{2}{3}$ of $\frac{1}{2}$ and $\frac{3}{5}$ of $\frac{5}{7}$ to simple fractions.
2. ……… $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ to a simple fraction.
3. ……… $\frac{4}{15}$ of $3\frac{3}{4}$ of 10 to a simple fraction.
4. ……… $\frac{3}{7}$ of $\frac{2}{5}$ of $\frac{1}{2}$ of 7 to a simple fraction.
5. ……… $9\frac{7}{20}$ and $\frac{3}{4}$ of $\frac{1}{20}$ to a simple fraction.

CASE VI. TO REDUCE LOWER DENOMINATIONS TO FRACTIONS OF HIGHER.

RULE. *Place the given number for the numerator, and as many as make one of the higher for the denominator. If the number be in more denominations than one, reduce them to the lowest for the numerator.*

Ex. 1. Reduce 7d. to the fraction of a shilling.
Thus 7d.$=\frac{7}{12}$ Answ.

Ex. 2. Reduce 16/5 to the fraction of a pound.

$$\frac{16/5=}{20/.\times 12=}\frac{197}{240}\ \text{Answ.}$$

Ex. 3. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.
$\frac{5}{6}$d. $= \frac{5}{6}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{5}{1440}$ or $\frac{1}{288}$ Answ.

Note. If a fraction be given, we may multiply its denominator by the value of the higher denomination. Thus in the following Example, $\frac{5}{6}$th of a penny, we multiply 6, the denominator, by 12 and 20, the value of a pound, and the product 1440 is the denominator of the fraction required.

Ex. 4. Reduce 4$\frac{1}{4}$d. to the fraction of a pound.
4$\frac{1}{4}$d. $= \frac{17}{4}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{17}{960}$ Answ.

EXERCISES.

Reduce as follows:

1. 5d. to the fraction of a sh.
2. 11d.................. of a £.
3. 12/4.................. of do.
4. 17/8$\frac{1}{2}$.................. of do.
5. $\frac{6}{7}$ of 1d.............. of a sh.
6. $\frac{7}{8}$ of 1d.............. of a £.
7. 9 dwts. 18 grs. ..... of a lb.
8. 3 oz. 10$\frac{2}{3}$ drs. .... of a lb.
9. 2 qrs. 16 lb.......... of a Cwt.
10. 5 stone wool .... of a pack.
11. 3 qrs. 21 lb.......... of a ton.
12. 12 gal. wine......... of a tun.
13. 2$\frac{3}{4}$d. to the fraction of a sh.
14. 6$\frac{2}{3}$d.................... of a £.
15. 3 qrs. 15$\frac{5}{6}$ lb......... of a Cwt.
16. 3$\frac{1}{3}$ inches............ of a foot.
17. $\frac{3}{4}$ of an inch......... of a yard.
18. 2 pecks 3 qts. .... of a bus.
19. 3 bus. 3 pecks ...... of a qr.
20. 48 gals. 7 pints...... of a hhd.
21. 14 per. 18 yds.......of an acre.
22. 2 ro. 24 per.......... of do.
23. 8 yds. 2$\frac{2}{3}$ feet........ of a mile
24. 14 ho. 40 min....... of a day·

CASE VII. TO FIND THE VALUE OF FRACTIONS.

RULE. *Reduce the numerator to the next lower denomination, and divide by the denominator. If there be a remainder, reduce it to the next denomination, and divide as before, and so on till the lowest name.*

Ex. 1. Value $\frac{19}{40}$ of a £.	Ex. 2. Value $\frac{43}{60}$ of a Cwt.	
19	43	
20	4	
40)380(9/6 Answ.	60)172(2 qrs. 24$\frac{4}{15}$ lb.	
360	120	
20	52	
12	28	
240	1456	
240	120	
	256	4|$\frac{16}{60} = \frac{4}{15}$
	240	
	16	

ELUCIDATION. In Ex. 1. we multiply the remainder by 20, and divide 380 the product by 40 the denominator of the fraction, and obtain a quotient of 9 shillings; we then multiply the remainder by

12, which produces 240, and divided by 40 quotes 6d. and no remainder. — In Ex. 2. we proceed in a like manner; and, as there is a remainder, the quotient is completed by a fraction.

EXERCISES.

What is the value of

1. $\frac{5}{12}$ of a shilling.
2. $\frac{11}{240}$ of £1.
3. $\frac{37}{80}$ of do.
4. $\frac{85}{96}$ of do.
5. $\frac{1}{280}$ of do.
6. $\frac{7}{1920}$ of £1.
7. $\frac{13}{320}$ of 1 lb. Troy.
8. $\frac{11}{48}$ of 1 lb. Avoir.
9. $\frac{9}{14}$ of 1 Cwt.
10. $\frac{1}{48}$ of a pack wool.
11. $\frac{3}{64}$ of a ton.
12. $\frac{1}{21}$ of a tun, wine.
13. $\frac{11}{48}$ of a shilling.
14. $\frac{1}{36}$ of £1.
15. $\frac{8}{9}$ of a Cwt.
16. $\frac{5}{18}$ of a foot.
17. $\frac{1}{48}$ of a yard.
18. $\frac{7}{32}$ of a bushel.
19. $\frac{9}{4}$ of a quarter.
20. $\frac{7}{8}$ of a hhd. beer.
21. $\frac{5}{64}$ of an acre.
22. $\frac{13}{20}$ of do.
23. $\frac{1}{198}$ of a mile.
24. $\frac{11}{18}$ of a day.

QUERIES.

1. How do you reduce mixt numbers to improper fractions?
2. How do you reduce improper fractions to whole or mixt numbers?
3. How do you reduce a fraction to its lowest terms?
4. How do you find a common measure to two given numbers?
5. How do you reduce fractions of different denominators to similar fractions of equal value?
6. How do you reduce a compound fraction to a simple one?
7. How do you reduce lower denominations to fractions of higher?
8. How do you find the value of fractions?

ADDITION OF FRACTIONS.

RULE. *Reduce mixt numbers to improper fractions; compound fractions to simple ones, and all the fractions to a common denominator: then add them. If the answer be an improper fraction, reduce it to a mixt number, or if it be a fraction of any denomination reduce it to value.*

Ex. 1. Add $\frac{5}{8}$ and $\frac{4}{5}$.

By Case 4. $\begin{cases} \frac{5}{8}=\frac{25}{40} \\ \frac{4}{5}=\frac{32}{40} \end{cases}$

By Case 2. …… $\frac{57}{40}=1\frac{17}{40}$

Ex. 2. …Add $\frac{3}{4}$ of $\frac{5}{6}$ and $\frac{4}{5}$ of $\frac{7}{8}$.

By Case 5. $\begin{cases} \frac{3}{4} \text{ of } \frac{5}{6}=\frac{15}{24} \text{ or } \frac{3}{8}. \\ \frac{4}{5} \text{ of } \frac{7}{8}=\frac{28}{40} \text{ or } \frac{7}{10}. \end{cases}$

By Case 4. $\begin{cases} \frac{3}{8}=\frac{30}{80} \\ \frac{7}{10}=\frac{56}{80} \end{cases}$

Sum $\underline{\underline{\frac{86}{80}=1\frac{3}{40}}}$ Ansr.

Ex. 3. ... Add £$\frac{5}{6}$ and $\frac{7}{8}$ shilling together.
By Case 7. £$\frac{5}{6}$=5×20=100÷6=£0„16„ 8.
sh. $\frac{7}{8}$=7×12= 84÷8= 0„ 0„10$\frac{1}{2}$.
Answ. £0„17„ 6$\frac{1}{2}$.

EXERCISES.

1. Add $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$.
2. ...... $\frac{1}{4}$, $\frac{5}{7}$, $\frac{1}{5}$.
3. ...... $\frac{2}{3}$, $\frac{7}{8}$, $\frac{8}{9}$.
4. ...... $\frac{9}{10}$, $\frac{3}{2}$, $\frac{15}{16}$.
5. Add $\frac{4}{7}$ of $\frac{2}{3}$, $\frac{3}{5}$ of $\frac{7}{8}$.
6. ...... $3\frac{1}{3}$, $4\frac{2}{5}$, $7\frac{3}{4}$.
7. ...... $6\frac{1}{2}$, $9\frac{5}{8}$, $10\frac{1}{9}$.
8. ...... $16\frac{4}{11}$, $48\frac{2}{7}$, $63\frac{5}{8}$.

¶ 9. Add $\frac{5}{6}$ of a shilling to $\frac{3}{4}$ of a pound.
10. ...... $\frac{1}{2}$ of a penny, £$\frac{3}{8}$, and $\frac{2}{3}$ of a shilling.
11. ...... $\frac{7}{8}$ of a quarter, $\frac{2}{3}$ bush. and $\frac{3}{4}$ of a gallon.
12. ...... $\frac{4}{5}$ of a last, $\frac{5}{8}$ qr. $\frac{1}{4}$ bus. and $\frac{1}{2}$ of a peck.
13. ...... $\frac{8}{9}$ of a hhd. wine, and $\frac{3}{8}$ of a gallon.
14. ...... $\frac{5}{6}$ of a yard, $\frac{3}{4}$ feet, and $\frac{2}{3}$ of an inch.
15. ...... $\frac{1}{4}$ of a week, $\frac{7}{8}$, and $\frac{2}{5}$ of an hour.

QUERIES.

1. How do you add simple fractions?
2. How do you add compound fractions?
3. How do you add mixt numbers?
4. How do you add fractions of different denominations?
5. What is the reason that fractions of different denominators must be reduced to those of the same, before you can add them?

REMARKS. 1st. In order to assist the learner we shall here give a few particular directions how to *add* the several kinds of fractions.

(1.) To add *simple fractions;* reduce them to a common denominator by Case 4th; then add the numerators, and under their sum place the common denominator. See Exercises 1, 2, 3, 4.

(2.) To add *compound fractions;* reduce them to simple fractions by Case 5th, and proceed as before. See Exer. 5.

(3.) To add *mixt numbers;* we may either reduce them to improper fractions according to the rule by Case 1st, or we may find the sum of the fractions, and add it to that of the integers. This last method is the best. See Exer. 6, 7, 8.

(4.) Fractions of *different denominations* may be added either by reducing them to others of the same integer, or by reducing them separately to value by Case 7th, as in the 3d example above. See Exer. 9—15.

2d. The reason why fractions must be reduced to a common dedominator is, that none but similar or like parts can be added, and when fractions are reduced to the same denominators, the numerators signify like parts.

SUBTRACTION OF FRACTIONS.

Rule. *Prepare the fractions the same as for Addition; subtract the numerator of the subtrahend from the numerator of the minuend, and place the remainder above the common denominator.*

Ex. 1. Subtract $\frac{2}{3}$ from $\frac{4}{5}$
From $\frac{4}{5}\times3=\frac{12}{15}$
Sub. $\frac{2}{3}\times5=\frac{10}{15}$
Ans. $\frac{2}{15}$

Ex. 2. From $76\frac{2}{3}$ take $35\frac{7}{8}$
From $76\frac{2}{3}$ or $76\frac{16}{24}$
take $35\frac{7}{8}$ or $35\frac{21}{24}$
Remains $40\frac{19}{45}$

Elucidation. In Ex. 2d. because 21, the numerator of the *subtrahend* is greater than 16, the numerator of the *minuend*, we subtract 21 from 24, the common denominator, and there remain 3, which, added to 16, makes 19, for the numerator of the fraction in the remainder, and in subtracting the integers we add one to 5 the unit place of the subtrahend.

EXERCISES.

1. Sub. $\frac{3}{4}$ from $\frac{7}{8}$
2. ...... $\frac{2}{5}$ from $\frac{5}{6}$
3. ...... $\frac{1}{10}$ from $\frac{1}{9}$
4. ...... $\frac{2}{8}$ from $\frac{17}{20}$
5. ...... $\frac{5}{7}$ from $\frac{8}{11}$
6. From $\frac{8}{9}$ take $\frac{1}{3}$ of $\frac{5}{6}$
7. ...... $5\frac{3}{4}$ take $4\frac{2}{5}$
8. ...... $12\frac{1}{8}$ take $\frac{8}{9}$
9. ...... $54\frac{1}{2}$ take $\frac{3}{16}$
10. ...... 81 take $19\frac{5}{18}$

Remarks. 1st. We shall here subjoin a few particular directions for the assistance of the learner, in *subtracting fractions.*

(1.) To subtract *simple fractions;* reduce them to the same denominator, then subtract the numerator of the less fraction from the numerator of the greater. See Exercises 1—5.

(2.) To subtract *compound fractions;* reduce them to simple fractions, and proceed as before. See Exer. 6.

(3.) To subtract *mixt numbers;* reduce the fractions to the same denominator, and then subtract the fraction annexed to the less number, from the fraction of the greater, borrowing the value of the denominator, if necessary. See Exer. 7, &c.

(4.) To subtract *fractions of different denominations;* reduce them to their value, and then subtract the value of the less number from that of the greater. See Exer. 11—15.

(5.) To subtract a *fraction from an integer;* subtract the numerator from the denominator, and place the remainder above the denominator; prefix this to the integer diminished by unity. Exam. Subtract $\frac{7}{12}$ from 14. — remainder $13\frac{5}{12}$.

2d. As none but like parts can be added, so none but like parts can be subtracted; and therefore there is the same reason in *Subtraction,* for reducing the fractions as in *Addition.* The operations *of these Rules* will appear plain, if the numerators of the fractions

¶ 11. Sub. $\frac{1}{12}$ of a penny from $\frac{2}{3}$ of a shilling.
12. ...... $\frac{5}{8}$ of a shilling from $\frac{7}{9}$ of a pound.
13. ...... $\frac{3}{5}$ of a dwt. from $\frac{1}{3}$ of a lb. Troy.
14. ...... $\frac{4}{7}$ of a Cwt. from $\frac{7}{10}$ of a ton.
15. ...... $\frac{13}{16}$ of a yard from $\frac{3}{4}$ of an ell.

QUERIES.

1. How do you subtract simple fractions ?
2. How do you subtract compound fractions ?
3. How do you subtract mixt numbers ?
4. How do you subtract fractions of different denominations ?
5. How do you subtract a fraction from an integer ?
6. What is the reason why fractions must be brought to the same denominator before you can subtract them ?

MULTIPLICATION OF FRACTIONS.

Rule. *Reduce mixt numbers to improper fractions, and whole numbers to the form of fractions by putting* 1 *for the denominators; then multiply the numerators together for the numerator of the product, and the denominators for the denominator.*

Ex. 1. Multiply $\frac{4}{5}$ by $\frac{2}{3}$
Thus $\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$ Answer.

Elucidation. To multiply $\frac{4}{5}$ by $\frac{2}{3}$ is the same as to find what two thirds of $\frac{4}{5}$ comes to. Thus, as $\frac{4}{5}$ is equal to $\frac{12}{15}$, and $\frac{1}{3}$ of $\frac{12}{15}$ is $\frac{4}{15}$, consequently $\frac{2}{3}$ of $\frac{12}{15}$ is $\frac{8}{15}$, the same as above.

The following example is wrought by the above Rule, and also according to the 5th direction in the Remarks.

Ex. 2. Multiply $9\frac{3}{4}$ by $6\frac{2}{3}$.
By case 1. $9\frac{3}{4}=\frac{39}{4}$ and $6\frac{2}{3}=\frac{20}{3}$
Then $\frac{39}{4} \times \frac{20}{3} = \frac{780}{12}$ or 65 Answ.

Or,

$$\begin{array}{rr} 9\times6= & 54 \\ 9\times\frac{2}{3}= & 6 \\ \frac{3}{4}\times6= & 4\frac{1}{2} \\ \frac{3}{4}\times\frac{2}{3}= & \frac{1}{2} \\ \hline \text{as before} & 65 \end{array}$$

EXERCISES.

1. Mult. $\frac{5}{8}$ by $\frac{1}{2}$.
2. .... $\frac{6}{7}$ by $\frac{3}{4}$.
3. .... $\frac{7}{8}$ by $\frac{1}{3}$.
4. .... $\frac{8}{9}$ by $\frac{4}{7}$.
5. .... $\frac{1}{2}$ of $\frac{3}{5}$ by $\frac{3}{4}$.
6. .... $18\frac{1}{3}$ by $\frac{1}{3}$ of 5.
7. Mult. 115 by $\frac{7}{9}$.
8. .... 249 by $\frac{5}{6}$.
9. .... 65 by $7\frac{8}{11}$.
10. .... $26\frac{5}{7}$ by 13.
11. .... $87\frac{3}{4}$ by $\frac{9}{10}$.
12. .... $26\frac{4}{5}$ by $14\frac{2}{3}$.

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be considered as lower denominations, and added and subtracted as such, and the denominator considered as the value of the higher place.

¶ 13. What cost $\frac{7}{8}$ of a yard at $\frac{7}{8}$ of £1 ℘ yard?

14. How many square feet in a floor $16\frac{7}{8}$ feet by $15\frac{11}{12}$?

15. How many solid feet in a box $3\frac{1}{8}$ feet long, $2\frac{7}{12}$ broad, and 11 inches deep?

QUERIES.

1. How do you multiply a fraction by a fraction?
2. How do you multiply a whole number by a fraction?
3. How do you multiply a whole number by a mixt number?
4. How do you multiply a mixt number by a fraction?
5. How do you multiply when both factors are mixt numbers?
6. What is the reason that the *product* is less than the *multiplicand*, when we multiply by a fraction?

DIVISION OF FRACTIONS.

RULE. *Prepare the fractions the same as in Multiplication, then multiply the numerator of the dividend by the denominator of the divisor, and the denominator of the dividend by the numerator of the divisor; the first product will be the numerator of the quotient, and the second its denominator.*

REMARKS. 1st. The above Rule for multiplying fractions is general, and may be extended to every case, when there are fractions in any of the factors; we shall, however, add a few particular directions:

(1.) To multiply a *fraction by a fraction;* multiply the numerators together for the numerator of the product, and the denominators for the denominator of it. See Exer. 1, 2, 3, 4.

(2.) To multiply *an integer by a fraction;* multiply it by the numerator, and divide the product by the denominator. See Exer. 7 and 8.

(3.) To multiply *an integer by a mixt number;* multiply it, first by the integer, and then by the fraction. See Exer. 9.

(4.) To multiply *a mixt number by a fraction;* multiply it by the numerator of the fraction, and divide by the denominator. See Exer. 11.

(5.) When *both factors are mixt numbers;* multiply each part of the multiplicand, first by the integer of the multiplier, and then by the fraction, and add the four products: or, reduce both factors to improper fractions. See Ex. 2. and Exer. 12.

2d. Multiplication by a proper fraction gives a *product* less than the *multiplicand.* The reason is, that multiplication is the taking of the multiplicand as often as there are units in the multiplier; and therefore, if the multiplier be less than unity, the product will, in the same proportion, be less than the multiplicand. Thus, if we multiply by $\frac{1}{2}$, $\frac{1}{3}$, or the like, we obtain the same answer as when we divide by 2 or 3, and the product in this case will be equal to $\frac{1}{2}$ or $\frac{1}{3}$ of the multiplicand.

Ex. 1. Divide $\frac{7}{8}$ by $\frac{1}{3}$.

$\frac{1}{3})\frac{7}{8}(\frac{21}{8}$ or $2\frac{5}{8}$ Ans.

Ex. 2. Divide $674\frac{5}{12}$ by 8.

By Case 1st. $674\frac{5}{12}=\frac{8093}{12}$.

$\frac{1}{8})\frac{8093}{12}(\frac{8093}{96}$ or $84\frac{29}{96}$ Ans.

Note. Ex. 2. may be wrought in the following manner:—Divide 674 by 8; the quotient is 84, and the remainder 2, to which annex the fraction $\frac{5}{12}$ in the dividend; and reduce the mixt number $2\frac{5}{12}$ to an improper fraction, which gives $\frac{29}{12}$, and multiply its denominator by 8, which makes the remainder to be $\frac{29}{96}$.

EXERCISES.

1. Divide $\frac{5}{6}$ by $\frac{1}{3}$.
2. .... $\frac{17}{18}$ by $\frac{5}{9}$.
3. .... $\frac{15}{16}$ by $\frac{3}{16}$.
4. .... $\frac{25}{32}$ by $\frac{4}{7}$.
5. .... $1\frac{11}{12}$ by $\frac{1}{2}$ of $\frac{3}{4}$.
6. .... $\frac{5}{8}$ by 7.
7. Divide 143 by $\frac{6}{7}$.
8. .... 112 by $\frac{8}{11}$.
9. .... 68 by $5\frac{8}{9}$.
10. .... 86 by $7\frac{3}{5}$.
11. .... $1765\frac{8}{11}$ by 10.
12. .... $239\frac{3}{4}$ by $8\frac{1}{3}$.

¶ 13. How often is $\frac{3}{4}$ contained in 100?

14. Divide £72„11„3 into $18\frac{2}{3}$ shares.

15. How many stones, $17\frac{1}{3}$ inches by $13\frac{3}{8}$, will be required for a floor $35\frac{3}{4}$ feet by $19\frac{1}{4}$?

QUERIES.

1. How do you divide a fraction by a fraction?
2. How do you divide a whole number by a fraction?
3. How do you divide a fraction by a whole number?
4. How do you divide a mixt number by an integer?
5. How do you divide, when both divisor and dividend are mixt numbers?
6. What is the reason that the quotient is greater than the dividend, when we divide by a *proper* fraction?

Remarks. 1st. The Rule given above being general, extends to every case, by reducing integers and mixed numbers to the form of fractions. It may, however, be useful to the learner to give particular directions in dividing the several kinds of fractions which will occur.

(1.) To divide a *fraction by a fraction;* invert the divisor, by placing the denominator for the numerator, and the numerator for the denominator, and proceed as in Multiplication. See Exer. 1, 2, 3, 4.

(9.) To divide an *integer by a fraction;* multiply it by the denominator of the divisor, and divide the product by the numerator. See Exer. 7, 8.

(3.) To divide a *fraction by an integer;* multiply the denominator by the divisor, and place the product under the numerator. See Exer. 6.

(4.) To divide a *mixt number by an integer;* divide the dividend by the divisor, and annex the fraction of the dividend to the re-

PRACTICAL QUESTIONS

IN

VULGAR FRACTIONS.

1. Divide a sovereign among three men, A. B. and C., so that their shares may be in the proportion of $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ respectively?

2. Required the product, and quotient of two fractions, *viz.* $\frac{6}{7}$ and $\frac{3}{4}$; and what is their difference supposing them parts of a guinea?

3. In a Commercial Academy, there are 240 pupils, $\frac{2}{3}$ of them are in Writing; of the remainder $\frac{5}{8}$ are in Arithmetic, and the rest in Book-keeping; required the number in each branch of education?

4. Whether is $\frac{7}{12}$ or $\frac{9}{16}$ the greatest fraction, and what is their difference, supposing them parts of a lb. either Troy or Avoirdupois weight?

5. A young lady's fortune was £1600, which was exactly $\frac{1}{2}$ of $\frac{3}{4}$ of her brother's; how much was his portion?

6. It is required to divide £2090 among three persons, giving B. $\frac{2}{3}$ of A.'s share, and C. $\frac{2}{4}$ of B.'s.?

7. A. has $\frac{3}{8}$ of a Steam-Boat, which cost £1800; he sells $\frac{1}{2}$ of his share to B., and $\frac{1}{3}$ of the remainder to C. at prime cost; what proportion of the boat now belongs to A., and how much will B. and C.'s shares come to?

8. The sum realized from a Bankrupt's effects was $\frac{3}{16}$ of his debts, which amounted to £7850; how much was recovered by the Assignees?

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mainder: the mixed number thus formed, reduce to an improper fraction, and multiply its denominator by the divisor. *The 2d Ex. is wrought by this method.* See Exer. 11.

(5.) When both *divisor and dividend are mixt numbers;* reduce each of them to an improper fraction; then either invert the divisor and proceed as in Multiplication, or according to the Rule. See Exer. 12.

2d. If the fractions to be divided have the *same denominator*, we have only to divide the numerator. Thus $\frac{12}{17}$ divided by $\frac{3}{17}$ quotes 4, and to divide $\frac{8}{12}$ by $\frac{9}{12}$ we have only to divide 8 by 9, which gives $\frac{8}{9}$. See Exer. 3.

3d. Dividing by a fraction less than unity, gives *a quotient* greater than the *dividend;* for according to the definition, the quotient shows how often the divisor is contained in the dividend; and consequently if the divisor be unity, the quotient will be equal to the dividend; and if the divisor be less than unity, the quotient will be greater than the dividend, for it is obvious that any number contains more halves, *more thirds*, or the like, than it contains units.

9. A Bankrupt's net subject is exactly $\frac{5}{12}$ of his debts; how much will his composition amount to ℔ pound?

10. A Merchant became insolvent, whose debts amounted to £14960, and which are $\frac{15}{4}$ of what will be recovered from his Estate; required how much he will pay ℔ pound, and how much his creditors will lose?

11. A Merchant's profits at Balancing his Books at the end of the year was $\frac{7}{24}$ of his capital advanced, which was £2520; required how much he cleared by his business?

12. Two persons are in Company whose shares are in proportion of $\frac{3}{4}$ to $\frac{2}{3}$. Their joint capital was £1860, and their profits at balancing Accounts £269„15; required how much each advanced and gained?

13. Three Partners engaged in a Mercantile Speculation; the money which A. advanced was $\frac{5}{4}$ of B.'s, and C.'s was $\frac{4}{5}$ of B.'s, which was £1200. The loss sustained by the Adventure was $\frac{7}{20}$ of the sum advanced; how much will each retire with?

14. A Person's Will specifies, that A. is to have $\frac{1}{3}$ of his money, B. $\frac{1}{4}$ of the remainder, C. $\frac{1}{5}$ of what was left, and D. the rest, which amounted to £390; required how much the rest received, and what proportion of the whole money D. received?

15. Divide £1483„15 among 12 men, 18 women, 6 boys, and 9 girls, giving a woman $\frac{1}{4}$ less than a man, a boy $\frac{1}{3}$ less than a woman, and a girl $\frac{1}{2}$ less than a boy: and prove the operation?

16. A Gentleman left £1200 to four poor relations: to A. he bequeathed $\frac{3}{8}$, to B. $\frac{3}{4}$ of A.'s legacy, to C. he left $\frac{1}{3}$ of B.'s, and to D. the remainder: required the share of each?

17. A Father bequeaths his property to his family in the following manner — To his eldest son $\frac{3}{8}$ of the whole, to his second son $\frac{2}{3}$ of the remainder, and the rest was to be divided equally between his wife and daughter. The property amounted to £6039„10; required the share of each?

18. A Man left his eldest son $\frac{5}{8}$ths of his property, to the younger $\frac{5}{8}$ of the remainder, and the rest to his wife; upon dividing the money it was found that the eldest son had £168„5 more than the younger; how much should their mother have received, and how much money was left to the family?

19. If, in estimating the weight of Cattle, the four quarters are usually reckoned equal to $\frac{1}{2}$ of the beast, the tallow $\frac{1}{12}$, and the skin $\frac{1}{18}$; required what proportion of the weight is left for the rest?

20. Zaccheus the Tax-gatherer, mentioned in Scripture*, when brought to repentance, proposed to give $\frac{1}{2}$ of his goods to the poor, and to restore fourfold whatever he had exacted unjustly from any man. Now supposing, by doing so, he left himself nothing; what proportion of his wealth did he acquire by unjust means?

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* *Vide* St. Luke, chap. xix. ver. 8.

152512

DECIMAL FRACTIONS.

A Decimal Fraction is a fraction whose denominator is 10, 100, 1000, &c., or an unit with as many ciphers annexed to it, as the numerator has places.

Decimals are expressed by writing only the numerator with a point before it. Thus, $\frac{5}{10}$ is .5, and $\frac{25}{100}$ is .25, and $\frac{125}{1000}$ is .125, and so on.

Ciphers prefixed to a decimal, decrease its value in a tenfold proportion; that is, when one cipher is prefixed, the decimal will be only the 10th part of its former value; when two ciphers are prefixed, it will then be the 100th part of its first value, and so on; but the value of decimals is neither increased nor diminished by annexing ciphers.

Decimals are distinguished into two kinds, *terminate* and *interminate*, or as they are sometimes called, finite and infinite decimals.

Interminate decimals are divided into two classes, *repeating* and *circulating* decimals.

QUERIES.

1. What is a decimal fraction?
2. How are decimals distinguished from integers?
3. What effect have ciphers on a decimal?
4. How are decimals distinguished?
5. How are interminate decimals classed?

Remarks. The Notation of Decimals will be obvious from the following examples: —

.5 Signifies five-tenths, or $\frac{5}{10}$.
.05 .... five-hundredth parts, or $\frac{5}{100}$.
.005 .... five-thousandth parts, or $\frac{5}{1000}$.
.125 .... one hundred and twenty-five thousandth parts, or $\frac{125}{1000}$.
6.500 .... six and five-tenths, or $6\frac{5}{10}$.

2d. From these examples it appears, that the value of decimals depends upon their distance from the *decimal point;* and that the use of ciphers in decimals, as well as in integers, is to bring the significant figures to their proper places on which their value depends. As ciphers when placed on the left of an integer have no signification, but when placed on the right, each cipher increases the value ten times; so ciphers when placed on the right of a decimal have no signification, because its distance from the *point* is not altered; but when placed on the left, each cipher diminishes the value ten times, because it is thereby removed farther from the *point* or unity.

The figures next the *decimal point* signify tenth parts, the next *hundredth parts,* the next thousandth parts, and so on.

REDUCTION OF DECIMALS.

CASE I. TO REDUCE A VULGAR FRACTION TO A DECIMAL.

RULE. *Annex ciphers to the numerator, and divide by the denominator; but if it be necessary to annex more than one cipher before dividing, prefix a cipher to the quotient for each cipher thus annexed.*

Ex. 1. Reduce $\frac{17}{50}$ to a decimal.	2. Red. $\frac{1}{16}$ to a decimal.
50)17.00	16)1.00000
.34	.0625

ELUCIDATION. The reason of this operation will be evident, if we consider that the numerator of a vulgar fraction is understood to be divided by the denominator; and this division is actually performed when reduced to a decimal. Thus, in Ex. 1. $\frac{17}{50}$, or 17 divided by 50, is equal to 1700 hundred parts by 50, that is, to 34 hundred parts, or 34 as above.

The following Examples exhibit the different kinds of *Interminate* decimals:

Ex. Red. $\frac{2}{9}$	Red. $\frac{7}{12}$	Red. $\frac{3}{11}$	Red. $\frac{51}{55}$.
9)2.0	12)7.0	11)3.0	55)51.0
$.\dot{2}22$	$.58\dot{3}$	$.\dot{2}\dot{7}$	$.9\dot{2}\dot{7}$
A pure repeater.	*A mixt repeater.*	*A pure cir.*	*A mixt cir.*

Note. Repeaters are, for distinction, marked either with a *point* or *dash*; and circulates with a point over the *first* and *last* figures of the circle. The figures before the repeating ones are called the finite part.

EXERCISES.

1. Reduce $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ to decimals.
2. .... $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$, $\frac{1}{16}$, $\frac{3}{16}$, $\frac{5}{16}$ to decimals.
3. .... $\frac{7}{16}$, $\frac{9}{16}$, $\frac{11}{16}$, $\frac{13}{16}$, $\frac{15}{16}$, $\frac{1}{20}$, $\frac{3}{20}$ to decimals.
4. .... $\frac{7}{20}$, $\frac{9}{20}$, $\frac{11}{20}$, $\frac{13}{20}$, $\frac{17}{20}$, $\frac{19}{20}$, $\frac{37}{40}$ to decimals.
5. .... $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{5}{6}$, $\frac{7}{12}$, $\frac{11}{12}$ to decimals.
6. .... $\frac{8}{15}$, $\frac{4}{21}$, $\frac{7}{22}$, $\frac{5}{60}$, $\frac{2}{75}$, $\frac{1}{99}$ to decimals.

REMARKS. In reducing vulgar fractions to decimals, finite decimals are known by the quotient, or decimals having no remainder.

2d. A repeating decimal is known from the quotient repeating the same figure. If the figure repeat from the beginning, the decimal is a *pure repeater*. If there be figures before the repeater, it is called a *mixt repeater*, and the repeating figure is marked either with a *point* or *dash* for distinction.

3d. A circulating decimal is known from the quotient repeating two or more figures continually. If the figures circulate from the

CASE II. TO REDUCE LOWER DENOMINATIONS TO DECIMALS OF HIGHER.

RULE. *Annex ciphers to the lower denomination, and divide it by as many as make one of the higher. If there be several denominations, begin at the lowest, and reduce it to the next higher; to this prefix the number belonging to it, and reduce it to the next higher denomination, and so on to the last.*

EXAMPLES.

1. Reduce 12/8¼ to the decimal of £1.

```
 4| 1.0
  |------
12| 8.25
  |--------
20|12.6875
  |----------
  |   .634375
  |==========
```

2. Reduce 3 qrs. 7 lb. to the decimal of an Cwt.

```
   { 7|7.0                lb.
28 {  |-----      .112|91.0
   { 4|1.0            |--------
      |----- or       |   .8125
    4|3.25            |========
      -----
      .8125
      =====
```

ELUCIDATION. In Ex. 1st. To reduce ¼d. to a decimal, we annex a cipher, and divide by 4, the value of a penny, which gives .25; we next prefix 8d. to it, and divide by 12, the value of a shilling, and it comes to .6875; and then prefix 12/. and divide by 20, the shillings in a pound. The quotient is the decimal required. Or, we might have reduced 12/8¼ to farthings, and divided them by 960, the farthings in a pound.

In Ex. 2d. we divide by 7 and 4, the component parts of 28; the decimal we obtain is .25, to which we prefix the 3 qrs. and divide by 4, the qrs. in a Cwt.; or we may reduce the 3 qrs. to lbs. and take in 7 the odd lbs. which make 91, and then divide at once by 112, the lbs. in Cwt. as in the *second method.*

EXÊRCISES.

1. Reduce 1½d., 3¾d., 4½d., to the decimal of a shilling.
2. .... 7½d., 9¾d., 10½d., to ditto, ditto.
3. .... 2/6, 3/9, 4/3, 5/7½, to the decimal of a £.
4. .... 6/0¾, 7/6, 8/9, 9/3, to ditto.
5. .... 10/6, 11/9, 12/3, 13/7½, to ditto.
6. .... 14/10½, 15/6, 17/6, 19/9¾, to ditto.
7. .... 6/8, 8/4, 11/10, 13/4, 16/8, 19/11, to ditto.

¶8. .... 6 oz. 8 drs. Avoir. to the decimal of a lb.

---

decimal point, the decimal is a *pure circulate.* If there are figures before the circle, the decimal is called a *mixt circulate*, and the figures which circulate are marked with a point over the *first* and *last* figures of the circle.

4th. When the decimals would extend to a great many places, we may carry them out to three, four, five, or more places, according to the nature of the articles and the degree of accuracy required, and reject the rest as inconsiderable. The answer we obtain is sufficiently exact for any purpose in business.

9. Reduce 3 qrs. 21 lb. to the decimal of an Cwt.
10. .... 15 Cwt. 1 qr. 14 lb. to the decimal of a ton.
11. .... 3 roods 5 perches, to the decimal of an acre.
12. .... 4 furlongs 15 poles, to the decimal of a mile.

Case III. To find the Value of a Decimal.

Rule. *Multiply the decimal by the value of the different denominations, always pointing off, from the right, as many places as were in the preceding multiplicand. The figures pointed off give the answer.*

Note. If the decimal be a repeater, carry by nine, in multiplying the right-hand figure; and if there be a cipher on the right of the multiplier, annex the repeating figure for it. See 2d. Ex.

EXAMPLES.

1. Value .634375 of £1.
20
12.687500
12
8.2500
4
$\frac{1}{4}$.00 Answ. 12/8$\frac{1}{4}$

2. Value .91$\dot{6}$ of £.
20
18.3$\dot{3}$3
12
4. =18/4 Ans.

EXERCISES.

1. Value .125, .25, .625, .75, of a shilling.
2. ...... .175, .95, .725, .5875, of a pound.
3. ....$\dot{3}$33, .8$\dot{3}$, 408$\dot{3}$, .$\dot{6}$66, of ditto.
4. ...... .6875, .8$\dot{3}$, .76$\dot{3}$, .41$\dot{6}$, of a Cwt.
5. ...... .1875, .$\dot{6}$66, of a quarter of corn.
6. ...... .125, .74$\dot{8}$, of a mile.
7. ...... .875, .9$\dot{3}$, of an acre.
8. ...... .325, .58$\dot{3}$ of a yard.

Case IV. To reduce a terminate Decimal to a vulgar Fraction.

Rule. *Place the given decimal for the numerator, and an unit, with as many ciphers annexed to it as there are ciphers in the decimal, for the denominator. Then reduce the fraction to its lowest terms.*

Ex. Reduce .125 to a vulgar fraction.
.125=$\frac{125}{1000}$, or when reduced, is $\frac{1}{8}$ Answer.

EXERCISES.

1. Reduce .6, .25, .75, .875 to vulgar fractions.
2. .... .16, .85, .995, .9375 to vulgar fractions.
3. .... .05, .76, .005, .00224 to vulgar fractions.

CASE V. TO REDUCE A PURE REPEATER, OR PURE CIRCULATE, TO A VULGAR FRACTION.

RULE. *Place 9 for the denominator of the repeater, and 9 for every figure in the circle.*

EXAMPLES.

1. Red. $.\dot{6}$ to a vulgar fraction.	2. Red. $.\dot{8}\dot{1}$ to a vulgar fraction.
$.\dot{6}=\frac{6}{9}$ or $\frac{2}{3}$ Ansr.	$.\dot{8}\dot{1}=\frac{81}{99}$ or $\frac{9}{11}$ Ansr.

ELUCIDATION. If $\frac{}{9}$ be reduced to a decimal, it will produce a pure repeater, $.\dot{1}$, and $.\dot{1}$ is the decimal equal to $\frac{1}{9}$, $.\dot{2}=\frac{2}{9}$, $.\dot{3}=\frac{3}{9}$, and so on till $.\dot{9}=\frac{9}{9}$; hence every repeating figure is the numerator of a fraction whose denominator is 9.

EXERCISES.

1. Reduce $.\dot{3}$, $.\dot{6}$, $.\dot{7}$ to vulgar fractions.
2. .... $.\dot{3}\dot{6}$, $.\dot{7}\dot{2}$, $.\dot{0}\dot{9}$, $.\dot{9}\dot{0}$ to vulgar fractions.
3. .... $.\dot{1}4\dot{8}$, $.\dot{0}3\dot{7}$, $.\dot{7}14\dot{5}$ to vulgar fractions.

CASE VI. TO REDUCE A MIXED REPEATER, OR CIRCULATE, TO A VULGAR FRACTION.

RULE. *Subtract the finite part from the whole decimal, the remainder is the numerator; then place 9 below each figure of the circle, with a cipher for every place for the denominator.*

EXAMPLES.

1. Red. $58\dot{3}$ to a vulgar fraction.	2. Red. $.9\dot{2}\dot{7}$ to a vulgar fraction.
Finite part 58	Sub. 9
$\frac{525}{900}$ or $\frac{7}{12}$ Ansr.	$\frac{918}{990}$ or $\frac{51}{55}$ Ansr.

ELUCIDATION. The reason of this operation may be illustrated by dividing the decimal into its *finite* and *circulating* parts. Thus, in Ex. 2d, the finite decimal is 9, and the circle $.0\dot{2}\dot{7}$; but $9=\frac{9}{10}$, and $.0\dot{2}\dot{7}$ should be $\frac{27}{99}$ provided the circulation began at the decimal point, but as it begins after the place of tenths, it is $\frac{27}{99}$ of $\frac{1}{10}$, or $\frac{27}{990}$. The sum of the two fractions should be the value of the decimal required. To add them, we reduce them to the same denominator: Thus $\frac{9}{10}=\frac{891}{990}$, and add to it $\frac{27}{990}$, the sum is $\frac{918}{990}$ or $\frac{51}{55}$, which is the same as by the Rule.

EXERCISES.

1. Reduce $.1\dot{6}$, $.8\dot{3}$, $.01\dot{3}$, $.3\dot{2}\dot{7}$, $.958\dot{3}$ to vulgar fractions.
2. .... $.\dot{4}2\dot{9}$, $.81\dot{2}$, $.11\dot{3}\dot{6}$, $.5\dot{6}8\dot{1}$ to vulgar fractions.

☞ As the Arithmetic of *circulating decimals* is of little or no use in Business, we shall follow the subject no farther: the Rules we have given for reducing them to vulgar fractions are sufficient to solve any questions in which such decimals occur.

CONTRACTIONS.

I. To reduce, by inspection, *Shillings*, *pence*, and *farthings* to a decimal of a *Pound Sterling* of three places.

Take half the number of shillings for the first decimal place; and the number of farthings in the remainder, increased by 1, *if it amount to* 24 *or upwards; by* 2, *if it amount to* 48 *or upwards; and by* 3, *if it amount to* 72 *or upwards, for the two next places.*

Ex. 1. Reduce 5/2¾=261.
2. .... 8/5½=422.
3. .... 12/8 =633.
4. .... 15/0½=752.
5. .... 11/8¼=584.

EXERCISES.

1. Reduce 7/5¼.
2. .... 9/11.
3. .... 13/9½.
4. .... 15/8.

ELUCIDATION. In Ex. 1. we compute thus: — The half of 5/. is 2/. which is the first decimal place, and a shilling over, which, together with the 2¾d. makes 14¾d. or 59 farthings, to which add 2, by the rule, because it exceeds 48. We proceed in a similar manner with the other examples.

II. To value, by inspection, the decimal of a *Pound Sterling*.

Double the first decimal place for shillings; if the figure in the second place be 5, *or more than* 5, *reckon a shilling more; subtract* 5 *from the second place; the remainder in the second and third place is farthings, abating* 1 *for* 25, *and* 2 *for* 40.

Ex. 1. Value .423 = 8/5¾
2. ...... .634 =12/8¼
3. ...... .785 =15/8½ Answers.
4. ...... .93 =18/7¼
5. ...... .3865= 7/8¾

ELUCIDATION. In Ex. 1. we proceed thus: — Twice .4 is 8/. and 23 farthings is 5¾d. In Ex. 2. twice .6 is 12/., and because 34 comes to 25 and upwards, we deduct 1, which makes 33 farthings, or 8¼d. In Ex. 3., because 8 in the second decimal place is 5 and upwards, we add 1 to twice .7, the first decimal place, which gives 15/., then we take 5 from 8, and the remainder is farthings; abating as before, comes to 8½d. In Ex. 4. the third decimal place is supposed to be filled up with a cipher, which makes 30, and abating 1 is 29 farthings, or 7¼d. In Ex. 5. the fourth decimal place is rejected, being less than farthings.

EXERCISES.

1. Value by inspection, .158, .709, .166, .880 of £1.
2. .... .999, .095, .9975, .020, .05, .025, .00325 of ditto.
3. .... .365, .95, .5875, .0075, .730, .91, .098 of ditto.
4. .... .987, .876, .123, .402, .567, .117, .171 of ditto.
5. .... .809, .73, .146, .208, .292, .514, .657 of ditto.

III. To value by inspection the decimal of *an Cwt.*

To the first three figures of the given decimal add the first figure, divide the sum by 9, and the quotient gives the answer in lbs.

Note. If the figure in the fourth place of the decimal be 5 or upwards, add 1 to the sum before you divide. See Ex. 2.

Ex. 1. Value .36607 of a Cwt.
Thus 369+9=41 lbs. Answ.

Ex. 2. Value .1875 of a Cwt
Thus 189+9=21 lbs. Answ

EXERCISES.

1. Value .15178, .47321, .57142 of a Cwt.
2. .... .875, .76785, .99107 of ditto.

QUERIES.

1. How do you reduce a vulgar fraction to a decimal?
2. In reducing vulgar fractions to decimals, how are finite decimals known?
3. How do you know a repeating decimal?
4. How do you know a circulating decimal?
5. How do you reduce lower denominations to decimals of higher, and shillings and pence to the decimal of a pound?
6. How do you proceed when the decimal would extend to a great many places?
7. How do you find the value of a decimal?
8. How do you reduce a finite decimal to a vulgar fraction?
9. How do you reduce a pure repeater, or circulate, to a vulgar fraction?
10. How do you reduce a mixed repeater, or circulate, to a vulgar fraction?
11. How do you value by *inspection* the decimal of a pound sterling?
12. How do you value by *inspection* the decimal of a Cwt.?

ADDITION OF DECIMALS.

General Rule. *Set down the numbers so that the decimal points and like places may be under each other.*

Case I. *To add finite decimals, sum them up as if they were integers.*

EXAMPLES.

1st. Add together 68.075, .68075, 73.865, and 178.

$$\begin{array}{lr} \text{Thus} & 68.075 \\ & .68075 \\ & 73.865 \\ & 178. \\ \hline \textit{Answ.} & 320.62075 \end{array}$$

$$\begin{array}{lrcl} \text{Ex. 2.} & 46\frac{7}{8} & = & 46.875 \\ & 32\frac{2}{5} & = & 32.4 \\ & 54\frac{3}{4} & = & 54.75 \\ & 19\frac{1}{40} & = & 19.025 \\ \hline \text{Answ.} & 153\frac{1}{20} & = & 153.050 \end{array}$$

EXERCISES.

1. Add 65.165, 48.0125, 14.5, 610, 0325.
2. …… 3624, 362.4, 36.24, 3.624, .3624, 142.275.
3. …… $47\frac{1}{4}$, $28\frac{1}{2}$, $54\frac{3}{4}$, $31\frac{1}{5}$, $19\frac{3}{5}$, $112\frac{9}{20}$, $63\frac{5}{16}$, $56\frac{7}{10}$.
4. Reduce and add £24„6„3, £42„0„$10\frac{1}{2}$, £35„13„$8\frac{1}{4}$, £56„1„$9\frac{3}{4}$, £12„17„$4\frac{1}{2}$.
5. Reduce and add 37 Cwt. 1 qr. 14 lb., 15 Cwt. 0 qr. 21 lb., 9 Cwt. 2 qrs., 20 Cwt. 3 qrs. 7 lb.

Case II. *To add when the decimals repeat, extend the repeaters one place more than the longest finite ones, and carry by 9 on the right.**

EXAMPLES.

1. From	£176„11„ 8	=	$176.58\dot{3}$	2.	£105„12„ 6
Take	87„13„ 4	=	87.666		29„ 6„ 8
Diff.	£ 88„18„ 4	=	£ $88.91\dot{6}$	*Difference*	£ $76.291\dot{6}$

EXERCISES.

1. What is the sum of $98.\dot{6}$, $123.\dot{3}$, $67.8\dot{3}$, .125.
2. Reduce and add $54\frac{1}{3}$, $45\frac{5}{6}$, $68\frac{11}{12}$, and $156\frac{7}{8}$.
3. Reduce and add $27\frac{1}{8}$, $15\frac{1}{6}$, $12\frac{1}{9}$, and $18\frac{2}{3}$.
4. Reduce and add £16„3„4, £21„19„11, £18„0„$6\frac{3}{4}$, and £9„12„9.

QUERIES.

1. How do you write decimals to be added?
2. How do you add finite decimals?
3. How do you add when the decimals repeat?
4. Why do you extend the repeaters a place beyond the longest finite decimals, and carry by 9 at the right hand figure?

SUBTRACTION OF DECIMALS.

General Rule. *Place the less number under the greater, so that like places stand under each, as in Addition.*

Case I. *To subtract finite decimals, proceed as in integers, and make the decimal point in the difference directly under the two other points.*

---

* The reason why we extend the repeaters a place beyond the longest finite decimals, and carry by 9 at the right hand figure, is, because by this operation like things come to be added; for the finite decimals are tenth parts, but repeaters signify ninth parts.

EXAMPLES.

$$\begin{array}{llr}
1. & \text{From} & \pounds 147.5 \\
 & \text{Take} & 16.325 \\
\hline
 & \textit{Difference} & \pounds\ 131.175 \\
\hline\hline
\end{array}
\qquad
\begin{array}{llrcr}
2. & \text{From} & \pounds 162\,{,,}\ 1\,{,,}\ 3 & = & 162.0625 \\
 & \text{Sub.} & 85\,{,,}14\,{,,}\ 9 & = & 85.7375 \\
\hline
 & \textit{Diff.} & \pounds 76\,{,,}\ 6\,{,,}\ 6 & = & \pounds 76.325 \\
\hline\hline
\end{array}$$

EXERCISES.

1. From 67.385 take 49.5.
2. From 18.005 take .18005.
3. From .6875 deduct 1817.
4. From 1805 subtract 1.805.
5. From $96\frac{7}{8}$ subtract $69\frac{9}{16}$.
6. Find the difference between $75\frac{21}{40}$ and $56\frac{5}{8}$.
7. Subtract $17\frac{1}{25}$ from $84\frac{1}{2}$.
8. Subtract .975 from 100.
9. What is the difference between six tenths, and five hundred parts
10. How much does an unit exceed five thousandth parts ?

Case II. *To subtract repeaters, extend them as in Addition, and borrow nine on the right, if necessary.*

EXAMPLES.

$$\begin{array}{llr}
1. & \text{From} & .925\ \text{take}\ \frac{7}{9}. \\
 & & .7777 \\
\hline
 & \textit{Diff.} & .147\dot{2} \\
\hline\hline
\end{array}
\qquad
\begin{array}{llrcr}
2. & \text{From} & \pounds 176\,{,,}11\,{,,}\ 8 & = & 176.58\dot{3} \\
 & \text{Sub.} & 87\,{,,}13\,{,,}\ 4 & = & 87.666 \\
\hline
 & \textit{Diff.} & \pounds 88\,{,,}18\,{,,}\ 4 & & \pounds 88.91\dot{6} \\
\hline\hline
\end{array}$$

EXERCISES.

1. Find the difference between $108.\dot{6}$ and 89.125.
2. Required the difference between $190\frac{5}{15}$ and $109\frac{7}{15}$.
3. From £100 take £19„19„11.

QUERIES.

1. How do you place decimals to be subtracted ?
2. How do you subtract finite decimals ?
3. How do you subtract repeaters ?

MULTIPLICATION OF DECIMALS.

General Rule. *Point off as many decimal places from the right of the product, as there are in both factors; if the product has not so many places, prefix ciphers to make up the deficiency.**

---

* The reason of pointing off as many decimal places in the product, as there are in both factors, appears by considering that the *operation here* is the same as in Multiplication of Vulgar Fractions;

Case I. *To multiply finite decimals, proceed as in integers.*

EXAMPLES.

1. Multiply .627 by .43

$$\begin{array}{r} .627 \\ .43 \\ \hline 1881 \\ 2508 \\ \hline .26961 \end{array}$$

2. Multiply .1685 by .15.

$$\begin{array}{r} .1685 \\ .15 \\ \hline 8425 \\ 1685 \\ \hline .025275 \end{array}$$

Elucidation. In Ex. 1. there are *three* decimal places in the multiplicand, and two in the multiplier, which makes five, we therefore point off, according to the rule, five in the product. In Ex. 2., because there are *six* decimal places in the factors together, and only five in the product, we prefix a cipher to supply the defect.

EXERCISES.

1. Mult. 282.5 by 2.64
2. ...... 1.736 by .125
3. ...... 1406 by .342
4. ...... .748 by .17
5. ...... 6.23 by .049
6. Mult. .875 by .125
7. ...... 436 by .436
8. ...... .00674 by .321
9. ...... .23 by .25
10. ...... 095 by .095

Case II. *When one of the factors is finite, and the other repeats; multiply by the finite factor, and carry by 9 on the right; then extend the products equal, and add them as in Addition where repeaters occur.*

EXAMPLES.

1. Mult. $123.\dot{4}$ by .8

$$\begin{array}{r} 123.\dot{4} \\ 8 \\ \hline \text{Answ. } 99.7\dot{5} \end{array}$$

2. Mult. $321.\dot{6}$ by 2.5

$$\begin{array}{r} 321.\dot{6} \\ 2.5 \\ \hline 1608\dot{3} \\ 64333 \\ \hline \text{Ans. } 804.1\dot{6} \end{array}$$

EXERCISES.

1. Mult. .357 by $.\dot{3}$
2. ...... $2.8\dot{4}$ by 69
3. ...... $.91\dot{6}$ by 18.75
4. Mult. .145 by .48
5. ...... $70.8\dot{3}$ by 500
6. ...... .789 by $.\dot{4}$

---

for since each decimal place in either factor diminishes its value ten times, it must equally diminish the value of the product. Thus $.75 \times .25 = .1875$, and $\frac{75}{100} \times \frac{25}{100} = \frac{1875}{10000}$, which is the same.

Case III. *To multiply when both factors repeat; reduce either of them to a vulgar fraction, and take parts of the multiplicand for it.*

EXERCISES.

1. Mult. $176.\dot{3}$ by $.\dot{6}$
2. ...... $84.\dot{5}$ by $.\dot{8}$
3. Mult. $43.\dot{7}$ by $16.\dot{3}$
4. ...... $9.\dot{5}8\dot{3}$ by $8.01\dot{6}$

¶ 5. Mult. £98„6„8 by 3.65, and value the product.
6. ...... £123„8„10 by $1.1\dot{6}$, and value the product.
7. ...... £321„19„11 by $7.6\dot{3}$, and value the product.

CONTRACTIONS.

I. To multiply decimals by 10, we have only to remove the decimal place one place to the right; to multiply by 100, 1000, or the like, remove the point as many places to the right, as there are ciphers in the multiplier.

EXAMPLES.

Mult. 752 by 10, and 100.
Thus $752 \times 10 = 75.2$ ⎫
and $752 \times 100 = 7.52$ ⎭ Ans.

EXERCISES.

1. 56.9 by 10
2. 168.25 by 100
3. 3.15 by 1000

II. To multiply any number by a *pure repeater*, multiply by the numerator, and divide by 9.

Note. To multiply by $.\dot{3}$, take $\frac{1}{3}$ of the multiplicand, and to multiply by $.\dot{6}$, take $\frac{2}{3}$ of it, or subtract $\frac{1}{3}$.

EXAMPLES.

Mult. 87.5 by $.\dot{7}$

$$\begin{array}{r|l} & 7 \\ \hline 9 & 612.5 \\ \hline & 68.0\dot{5} \end{array}$$

EXERCISES.

1. 45.6 by $.\dot{2}$
2. 5.67 by $.\dot{3}$
3. $.678$ by $.\dot{6}$
4. 165 by $.\dot{8}$

III. To multiply decimals, and retain no more decimal places in the product than is required.

Invert the multiplier, and make the unit's figure stand under that place of decimals which is required in the product; then begin each line of the product by the multiplication of that figure in the multiplicand which stands above the figure you are multiplying by, including the carriage from the right, and write down the products, so that their right-hand figures may stand under each other.

Note. It is necessary to extend the product one place farther than the number of places required, because the last figure (*on account of the carriage*) cannot be depended on.

Ex. Mult. 6254 by .3542, so as to retain only four decimal places in the product.

Contracted way.					*Common way.*
.6254	or,	.6254		or,	.6254
.2453		.3542			.3542
18762		18762			12508
3127		3127	0		25016
250		250	16		31270
12		12	508		18762
.2215		.2215	1668		.22151668

EXERCISES.

1. Multiply .7834 by .3421, and let the product have only three places.
2. Multiply 16.2875 by 8.654 to have four decimal places.
3. Multiply .96543 by .46132 to have five decimal places.

QUERIES.

1. How do you multiply finite decimals?
2. How do you proceed if the product has not so many places as are necessary to be pointed off?
3. Why do you point off as many decimal places in the product as there are in both factors?
4. How do you multiply when one of the factors repeat?
5. How do you multiply when both factors repeat?
6. How do you multiply by 10, 100, 1000, or the like?
7. How do you multiply decimals, and retain in the product only such a number as may be required?

DIVISION OF DECIMALS.

General Rule. *Point off as many places in the quotient for decimals, as the number of decimals in the dividend exceed those in the divisor; if the quotient has not so many places, prefix ciphers.*[*]

Case I. *To divide finite decimals, proceed as in integers, and if there be a remainder, annex ciphers, and continue the division to as many places as are necessary.*

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[*] The reason of pointing off as many places in the quotient, as the number in the dividend exceeds that in the divisor, will easily appear, since the *quotient* multiplied by the *divisor* gives the *dividend;* and therefore the number of decimal places in the dividend must be equal to those in the divisor and quotient taken together.

EXAMPLES.

1. Divide 2175.36 by 1.32 Answer 1648
2. .... 21753.6 by .132 164800
3. .... 21.7536 by 13.2 .... 1.648
4. .... 2.17536 by 132 .... .01648

5. 16.25)383.75(23.61538+
3250
5875
4875
10000
9750
250, &c.

Note. The mark + subjoined to the quotient, signifies that the decimal is *less* than the truth, or requires something to be added. The mark — if placed at the end of a decimal, signifies that it is *greater*, and requires something to be subtracted.

EXERCISES.

1. Divide 353.25 by .15
2. .... 92017.8 by .218
3. .... 425.95 by 1.7
4. .... 17.8848 by 192.
5. .... 5000 by .0005
6. Divide 825 by .825
7. .... 645.87 by 98
8. .... 10.5 by .125
9. .... .3564 by 29
10. .... 1472.5 by 1500

CASE II. *When the dividend repeats, proceed as before; but after all the figures of it are brought down, annex the repeating figure to the remainder instead of ciphers.*

Ex. Divide $38.\dot{4}1\dot{6}$ by 6.25
6.25)$38.\dot{4}1\dot{6}$(6.30$\dot{6}$
3750
$191\dot{6}$
1875
4166
3750
416, &c.

EXERCISES.

1. Divide $150.\dot{6}$ by 1.5
2. .... $18.\dot{3}$ by 2.5
3. .... $169.\dot{3}$ by .05
4. .... $.91\dot{6}$ by 12

CASE III. *When the divisor, or both divisor and dividend repeat, multiply them both by any figure which will exterminate the repeater, and divide as before.*

Note. The digit 9 will always exterminate the repeater, but when *the repeating* figure is either 3 or 6, the *figure* 3 will do it.

Ex. Divide $158.\dot{8}$ by $2.\dot{7}$

$2.\dot{7}$) $158.\dot{8}$
9) 9
25.0) 1430.0(57.2 Ans.
125
180
175
50
50

EXERCISES.

1. Divide $4.21\dot{6}$ by $.\dot{5}$
2. .... $8.96\dot{2}$ by $.\dot{3}$
3. .... $3784\dot{5}$ by $.\dot{6}$
4. .... $545450.\dot{6}$ by $\overline{85}.3$

CONTRACTIONS.

I. To divide by 10, move the decimal point one place to the left; to divide by 100, 1000, or the like, move the point as many places to the left as there are ciphers.

Ex. Divide 9.375 by 10, and 100.
9.375 ÷ 10 = .9375
9.375 ÷ 100 = .09375

EXERCISES.

1. Div. 156.25 by 10
2. ...... 987.5 by 100
3. ...... 1817 by 1000

II. To divide any number by a pure repeater, multiply by 9, and divide by the repeating figure.

Note. To divide by $.\dot{3}$, multiply by 3, because $.\dot{3}=\frac{1}{3}$; and to divide by $.\dot{6}=\frac{2}{3}$, add one half of the dividend to itself.

Ex. Divide .1134 by $.\dot{7}$
9
7)10206
.1458 Ans.

EXERCISES.

1. Div. 3.65 by $.\dot{8}$
2. ...... 7.12 by $.\dot{3}$
3. ...... 2175 by $.\dot{6}$

III. To contract division when both factors consist of several places: having found the first figure of the product in the common way, for each after figure divide the last remainder, omitting a figure at each step on the right of the divisor, but including the carriage.

Ex. Divide 754.34738 by 12.269, and let the quotient have three decimal places.

Contracted way.

12.269)754.34738(6.148
73614
1820
1227
593
490
103
98
5

12.269)754.34738(6.148
73614
1820|7
1226|9
593|83
490|76
103|078
98|152
4|926

EXERCISES.

1. Divide .6436875 by .3785, and let the quotient have 3 places.
2. Divide 98.76543 by .4523, and limit the quotient to 4 places.
3. Divide 157.23841 by 6.257, and retain 5 places in the quotient.

QUERIES.

1. How do you divide finite decimals?
2. How do you fix the decimal point in the quotient?
3. How do you proceed when there are more decimals in the divisor than in the dividend?
4. How do you proceed, if, after the division is finished, the quotient has not so many decimals as the rule requires?
5. Why do you point off as many places in the quotient as the number in the dividend exceeds those in the divisor?
6. How do you divide when the dividend repeats?
7. How do you proceed when the divisor, or both divisor and dividend, repeat?
8. How do you divide by 10, 100, 1000, or the like?
9. How do you divide any number by a pure repeater?
10. How do you contract Division, when both factors consist of several places?

COMMISSION AND BROKERAGE.

Commission and Brokerage are allowances of so much ℘ Cent. to a Banker, an Agent, or Broker for transacting any kind of business for their Employers.

I. To compute the Brokerage on any Sum.

Rule. *As this allowance is generally less than* 1 ℘ *Cent. divide the Sum by* 100; *the quotient is equal to* 1 ℘ *Cent., of which take aliquot parts for the given rate, or proceed according to the following Table.*

TABLE OF BROKERAGE.

For $\frac{1}{10}$ ℘ Cent.	is 2/.	℘ £100	$=\frac{1}{1000}$ of the sum.
$\frac{1}{8}$	is 2/6	ditto	$=\frac{1}{800}$.
$\frac{1}{6}$	is 3/4	ditto	$=\frac{1}{600}$.
$\frac{3}{16}$	is 3/9	ditto	$=\frac{1}{800}$ and $\frac{1}{2}$ of that.
$\frac{1}{5}$	is 4/.	ditto	$=\frac{1}{500}$.
$\frac{1}{4}$	is 5/.	ditto	$=\frac{1}{400}$.
$\frac{1}{3}$	is 6/8	ditto	$=\frac{1}{300}$.
$\frac{3}{8}$	is 7/6	ditto	$=\frac{1}{400}$ and $\frac{1}{2}$ of that.
$\frac{1}{2}$	is 10/.	ditto	$=\frac{1}{200}$.
$\frac{5}{8}$	is 12/6	ditto	$=\frac{1}{200}$ and $\frac{1}{4}$ of that.
$\frac{3}{4}$	is 15/.	ditto	$=\frac{1}{200}$ and $\frac{1}{2}$ of that.
$\frac{7}{8}$	is 17/6	ditto	$=\frac{7}{800}$, or sub. $\frac{1}{800}$ of the sum

Exam. Find the Brokerage on £1162,,10, at ¾ ℘ Cent.

Method I.	Method II.	Method III.
½ | 11.62.5=£1.	Off ¼ ... 1162,,10	£11.625, or
½ | 5.8125	290,,12,,6	1 ℘ Cent.=£11,,12,,6
2.9062	8.71,,17,,6	Off ¼ 2,,18,,1½
8.718=£8,,14,,4½	20	£8,,14,,4½
	14.37	
	12	
	4.50	
	4	
	½...	

EXERCISES.

Calculate the Brokerage,

1. on £1275,,10, at $\frac{1}{16}$, ⅛, ⅙, and $\frac{3}{16}$ ℘ Cent.
2. on £1650,,15, at 2/. 2/6, 3/4, and 3/9 ℘ Cent.
3. on £1907,,10, at ⅕, ¼, ⅛, ⅗, and ⅛ ℘ Cent.
4. on £3210,, 5, at ⅜, ¾, and ⅛ ℘ Cent.

II. To calculate the Commission on any Sum.

Rule. *Multiply the Sum by the given rate ℘ Cent. and divide the product by* 100; *or take aliquot parts of* 100 *for the rate, which will be easily done by the following Table.*

TABLE OF COMMISSIONS.

For 1 ℘ Cent. or	£1 ℘ £100,	take	$\frac{1}{100}$ part of the sum.	
1¼	£1,, 5	ditto	......	$\frac{1}{80}$.
1½	£1,,10	ditto	......	$\frac{1}{100}$ and ½ of that.
2	£2	ditto	......	$\frac{1}{50}$.
2¼	£2,, 5	ditto	......	$\frac{1}{50}$ and add ⅛ of it.
2½	£2,,10	ditto	......	$\frac{1}{40}$.
3	£3	ditto	......	$\frac{1}{50}$ and add ½ of it.
3½	£3,,10	ditto	......	$\frac{1}{40}$ and $\frac{1}{100}$.
3¾	£3,,15	ditto	......	$\frac{1}{40}$ and add ½ of it.
4	£4	ditto	......	$\frac{1}{20}$ and sub. ⅕.
4½	£4,,10	ditto	......	$\frac{1}{20}$ and sub. $\frac{1}{10}$.
5	£5	ditto	......	$\frac{1}{20}$.
6	£6	ditto	......	$\frac{1}{20}$ and add ⅕ of it.
6¼	£6,, 5	ditto	......	$\frac{1}{20}$ and add ¼ of it.
7½	£7,,10	ditto	......	$\frac{1}{20}$ and add ½ of it.

Exam. Find the Commission on £789„15, at 2 and 2½ ℘ Cent.

Method I.
£789„15 at 2 ℘ Cent.
2
£15,79„10
20
sh. 15,90
12
pen. 10,8
4
¾

Method II. *by the Table.*
5,0)78,9.75
15.795=£15„15„10¾

Method I.
½ … £789.75 at 2½ ℘ Cent.
2½
1579.5
394.875
19.7437 = £19„14„10½

Method II. *by the Table.*
$\frac{1}{40}$|789„15
£19„14„10½

EXERCISES.

Calculate the Commission,

1. on £1526„5, at 1, 1¼, 1½, and 2 ℘ Cent.
2. on £972„17„6, at 2¼, 2½, 3, and 3½ ℘ Cent.
3. on £1813„13„4, at 4, 4½, 5, and 6 ℘ Cent.
4. on £2109„10, at 6¼, 6½, 7, and 7½ ℘ Cent.

QUESTIONS FOR PRACTICE.

1. A Broker procures sales for his Employer to the amount of £1850; how much is his allowance at ½ ℘ Cent.?

2. A Banker discounts Bills and does other business for his correspondent to the amount of £36627„10; how much does his commission come to at ⅓ ℘ Cent.?

3. Sold goods on Consignment to the amount of £2520„16„8; required my commission at 2 ℘ Cent.?

4. Purchased, for my Employer, goods value £625„10; how much does my commission come to at 2½ ℘ Cent.?

5. Rendered Account-Sales of a Consignment ℘ £571„8„4, charges of Freight, Cartage, and Porterage £14„16„8, Commission and risk of Bad debts 5 ℘ Cent.: required the net proceeds of the sales?

6. Sent my Employer, in Jamaica, an Account-Sales of 50 hhds. sugar, sold for £2750„18„9; commission 2½ ℘ Cent., and brokerage ½ ℘ Cent.; Duty, Freight, and other charges £935„7„6: required the proceeds due to him?

7. Transmitted my Correspondent an Account-Sales of 30 puncheons of rum, which sold for £605„11; the charges of Custom, Freight, &c. came to £213„17„6; Commission and guarantee 4 ℘ Cent.: how much do the net proceeds amount to?

8. Shipped, by my Employer's order, Goods to the amount of £561„4„10; charges of packing, cartage, and porterage, £3„15„6; wharfage, entry bond, and shipping charges, £5„10„8; commission 2½ ℘ Cent.: required the amount of the Invoice.

9. An Agent is allowed 6 ℘ Cent. for selling Goods, and to guarantee the debts to his employers. He does business to the extent of £18765„10 ℘ annum; what do his net profits amount to, supposing he loses by failures £452„12„6, and the necessary charges attending his business to be £196„15?

QUERIES.

1. What is Commission, or Brokerage?
2. How do you compute the brokerage on any sum?
3. How do you calculate the commission?

CALCULATION OF INTEREST.

INTEREST is an allowance given to the Lender of money by the Borrower, for the use he has had of the *Cash*.

The Principal is the Sum lent.

The Amount is the Sum of both principal and interest.

The legal interest is 5 ℘ Cent., or one-twentieth part of the sum, which is one year's interest of it, and a like proportion for a greater or less time.*

When no rate is mentioned, 5 ℘ Cent. is always understood, and is due on all debts after the expiration of the term of credit.

CASE I. TO CALCULATE INTEREST FOR YEARS.

RULE. *Divide the sum by 20; the quotient is one year's interest at 5 ℘ Cent., which multiply by the number of years for the answer; and for any other rate take a proportional part of this sum.*

EXAMPLES.

1. What is the interest of £284„10 for 3 years @ 5 and 4 ℘ Cent.?

$\frac{1}{20}$ | 284„10„0 @ 5 ℘ Cent.
14„ 4„6
3 yrs.
£ 42„13„6 = 5 ℘ Cent.

Off $\frac{1}{5}$ | 42„13„6 @ 5 ℘ Cent.
8„10„8¼ = 1 ℘ Cent.
Ans. £34„ 2„9¼ = 4 ℘ Cent.

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* The rate of interest may be under 5 ℘ Cent., if so stipulated between the parties; but more than 5 ℘ Cent. is called *usury*, and prohibited by the British laws. In many parts of the world, and also in the colonies belonging to Britain, however, a much higher rate of interest is given. In Ireland and America the rate is 6 ℘ Cent.; in the English settlements in New South Wales it is 8 ℘ Cent.; and in India 12 ℘ Cent.

EXERCISES.

1. What is the Interest of £1265 for 2 years @ 5 ⅌ Cent.?
2. .... of £815„10 for 3 years @ ditto?
3. .... of £789„5 for 5 years @ ditto?
4. .... of £950„15 for 7 years @ ditto?
5. .... of £543„6„8 for 10 years @ ditto?
6. .... of £365„17„6 for 6 years @ 4 ⅌ Cent.?
7. .... of £612„10 for 4 years @ 4½ ⅌ Cent.?
8. .... of £1050 for 5 years @ 4 ⅌ Cent.?
9. .... of £546„18„4 for 8½ years @ ditto?
10. .... of £730„15 for 5 years @ 6 ⅌ Cent.?

CONTRACTIONS.

1. As the interest at 5 ⅌ Cent. is $\frac{1}{20}$ part of the Sum, therefore

2 years = $\frac{1}{10}$	6 years = $\frac{3}{10}$	10 years = $\frac{1}{2}$	½ year, or 6 mo. $\frac{1}{40}$
3 ...... = $\frac{3}{20}$	7 ...... = $\frac{7}{20}$	12 ...... = $\frac{3}{5}$	⅓ ...... or 4 mo. $\frac{1}{60}$
4 ...... = $\frac{1}{5}$	8 ...... = $\frac{2}{5}$	15 ...... = $\frac{3}{4}$	¼ ...... or 3 mo. $\frac{1}{80}$
5 ...... = $\frac{1}{4}$	9 ...... = $\frac{9}{20}$	16 ...... = $\frac{4}{5}$	⅙ ...... or 2 mo. $\frac{1}{120}$

Note. If the rate be 4 ⅌ Cent. deduct $\frac{1}{5}$; and if 6 ⅌ Cent., add $\frac{1}{5}$ of the interest at 5 ⅌ Cent.

Thus, the interest of £461„10 at 5 ⅌ Cent. for 4 years
is $\frac{1}{5}$ of £461„10 or £92„6 Answ. at 5 ⅌ Cent.
If the rate was 4 ⅌ Cent. off $\frac{1}{5}$ 18„6
£74„ Answ. at 4 ⅌ Cent.

2. When the time is more than one year, multiply the *rate* by the *time*, and take aliquot parts of 100, from the following table, which will answer for any rate.

⅌ Cent.	Take of the sum	⅌ Cent.	Take of the sum
For 10	$\frac{1}{10}$	For 30	$\frac{1}{5}$ and add $\frac{1}{2}$ of that
12½	$\frac{1}{8}$	32½	$\frac{1}{5}$ and $\frac{1}{8}$, and add them
15	$\frac{1}{10}$ and $\frac{1}{2}$ of that	33⅓	$\frac{1}{3}$
17½	$\frac{1}{5}$ and sub. $\frac{1}{8}$ of that	35	$\frac{1}{4}$ and $\frac{1}{10}$, and add them
20	$\frac{1}{5}$	37½	$\frac{1}{2}$ and sub. $\frac{1}{4}$ of that
22½	$\frac{1}{5}$ and add $\frac{1}{8}$ of that	40	twice $\frac{1}{5}$, and add them
25	$\frac{1}{4}$	42½	twice $\frac{1}{5}$, and $\frac{1}{8}$ of $\frac{1}{5}$
27½	$\frac{1}{4}$ and add $\frac{1}{10}$ of that	45	$\frac{1}{4}$ and $\frac{1}{5}$, and add them

Ex. Find the Interest on £390„15 for 7½ years at 4 ⅌ Cent.

tim. ra.
7½ × 4 = 30 ⅌ ct. $\frac{1}{5}$ | 390„15„0
$\frac{1}{2}$ | 78„ 3„0 = 20 ⅌ ct.
39„ 1„6 = 10 ⅌ ct.
£ 117„ 4„6

or, 30 ⅌ Cent. is $\frac{3}{10}$ of the sum.
390„15
3
10)1172„ 5
£ 117„ 4„6

EXERCISES FOR PRACTICE.

Find the Interest, at 5 ℘ Cent.,

1. on £625„10, for 2½, 3, 3½, 4, and 4½ years.
2. …… 437„5, for 5, 6½, 7, 8½, and 9 years.
3. …… 342„15, for 5½, 6, 7½, and 8 years.

Find the Interest, at 4 ℘ Cent.,

4. on £511„10, for 2½, 5, 8⅓, and 10 years.

Find the Interest, at 3 ℘ Cent.,

5. on £730„15, for 5, 6⅔, 7½, and 10 years.

CASE II. TO CALCULATE INTEREST FOR MONTHS.

RULE. *Multiply the Sum by the number of months, and the product is the interest in pence at 5 ℘ Cent.*

Or, reckon a penny for pound in the sum for each month.

EXAMPLE.

Find the Interest on £50 for 3 months.

Method 1.	Method 2.	Method 3.
£50	1 mo.=4/2	4|50/.=12 mo
3 mo.	3	12/6
150 pence or 12/6	12/6	

EXERCISES.

1. Find the Interest on £35, for 1, 2, and 3 months.
2. ………………… on £45, for 2, 3, and 4 months.
3. ………………… on £67„10, for 1, 3, and 5 months.
4. ………………… on £78„5, for 2, 3, and 4 months.
5. ………………… on £130, for 1, 3, and 6 months.

CASE III. TO CALCULATE INTEREST FOR DAYS.

RULE. *Multiply the Sum by the number of days, and divide by 365 for the interest in* shillings, *or by* 7300, *for the interest in* pounds *at 5 ℘ Cent.: and for any other rate, take a proportional part.*

Note. To find the Interest on a Sum for a number of weeks, reduce the weeks to days, and proceed as above.

Calculate the Interest on £265* for 90 days.

Method 1.	Method 2.
£ 265	£265
90 da.	90 da.
365)23850(65/4 [illegible] £3„5„4	73.00)238.50(3.267
2190	219 £3„5„4
1950	195
1825	146
125	490
12	438
1500	520
1460	511
40	9

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* Men in business in computing interest for days, or discount on bills, omit the odd shillings in the sum if under 10; but if 10 or up-

Note. When the operation is performed by *Decimals*, and the rate of interest any other than 5 ⅌ Cent., multiply the quotient at 5 ⅌ Cent. by .6 for 3 ⅌ Cent.; by .7 for 3½ ⅌ Cent.; by .8 for 4 ⅌ Cent.; and by .9 for 4½ ⅌ Cent.

EXERCISES.

Find the Interest, at 5 ⅌ Cent.,

1. on £408·10, for 25, 30, 61, 92 days.
2. ...... 370·12·6, for 45, 60, 73, 124, 150 days.
3. ...... 657, for 70, 146, 219, 292 days.

Find the Interest, at 4 ⅌ Cent.,

4. on £627·15, for 29, 56, 83, 200 days.
5. ...... 438, for 30, 60, 120, 240 days.

Find the Interest, at 6 ⅌ Cent.,

6. on £365, for 42, 84, 168, 210 days.

Find the Interest, at 3 ⅌ Cent.,

7. on £581, for 66, 77, 88, 99, 187 days.

CONTRACTIONS.

1. Divide the *Sum* by 73, the quotient is the interest for 100 days; and for any other number, take a proportion.

2. Multiply the *Sum* by the days as before, and divide by 30; the quotient is the interest in pence, which reduce to shillings, and abate 1d. for every 6/.

Ex. Calculate the Interest on £435 for 80 days.

73 | 435
off ⅕ | 5·19· 2 = 100 days.
1· 3·10 = 20 days.
£4·15· 4 Answer.

£435
80 days.
3.0 | 3480.0
12 | 1160 pence.
96/8
Abate 1/4
£4·15·4

EXERCISES.

1. Find the interest on £292·10, for 25, 50, 75 days.
2. .... 315, for 90, 95, 100 days.
3. .... 420, for 110, 120, 125 days.

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wards they compute on even pounds; and fractions under ½d. are rejected in the interest, but if they are equal to ½d., the penny is charged.

CASE IV. TO CALCULATE INTEREST ON A DEBT, ON WHICH PARTIAL PAYMENTS HAVE BEEN MADE.

RULE. *Multiply the Sum, and the several balances by the number of days from each payment, and divide the sum of the products by* 7300. *The quotient is the legal interest.*

EXAMPLE.

A Bill of £360 was due April 10th, of which £180 was paid May 10th, £80 July 4th, and the balance on the 13th August: how much interest is due?

April 10th, Bill due, £360 × 30 days = 10800
May 10th, paid, ... 180
Bal. 180 × 55 = 9900
July 4th, paid 80
Bal. 100 × 40 = 4000
August 13th, paid ...... 100 73)24700
Interest £3.7.8 *Answ.*

Note. The above method of computing interest on debts when partial payments are made, is the most concise; the following method, however, is thought by some to be more easily understood.

Let the above Example be resumed.

April 10th, Bill of £360 due this day,
Interest till 13th August, 125 da. is £6. 3.3½
May 10th, paid £180, Int. till do. 95 da. £2.6.10
July 4th, paid ... 80, Int. till do. 40 da.... 0.8. 9½ 2.15.7½
Aug. 13th, paid ...100, the *Balance.*
£360 *Ans.* as above £3. 7.8

ELUCIDATION. Here we find the interest on the whole debt, from the time it became due, till 13th August, the time when the last payment was made, and extend the sum £6.3.3½. Next we find the interest on each payment till the same date, and subtract £2.15.7½, the sum of the interest on the payments from that of the whole debt, the difference, £3.7.8, is the interest due.

EXERCISES.

1. Required the Interest on £320, due 23d March, of which £110 was paid on the same day, £160 on the 30th May, and the balance on the 19th July following.

2. Find the Interest on £250 due 2d Feb., of which £50 was paid that day, £50 on 15th May, £50 on 1st August, and the balance on the 11th November.

3. A person borrowed £960 on 1st December, of which he paid £80 on the 1st January, and £80 on the first day of every suc-

ceeding month till the whole was paid up: how much legal interest is due?

4. A Bill of £240 became due on the 6th April, to discharge which the following payments were made: on the 29th June £95, on the 31st August £80, and the balance on the 12th October following, including interest: how much did the last payment amount to?

CASE V. TO CALCULATE INTEREST ON ACCOUNTS CURRENT.

RULE. *Find the interest, first of the Sums on the Dr. side of the Account, and then of those on the Cr. side, reckoning the time from the day which the sums become due, to the time to which the account is brought up. Subtract the sum of the interest on the one side from that of the other, and the difference is the interest to be carried to the proper side of the account current.*

EXAMPLES.

Required the interest on the following Account Current, up till 31st December.

Dr. Mr. Joseph Austin in Account Current with A. B. *Cr.*

May	15	To Balance ...	182	„	„	July	5	By Cash	198	10	„
June	29	To Bill due...	136	10	„	Oct.	10	By Cotton due	145	15	„
Sept	16	To Goods due	275	15	„	Nov.	18	By Rum due..	126	„	„

CALCULATION OF THE INTEREST.

Dr. Side,

May 15. to Dec. 31. is 230 da. on £182 is £5„14„
June 29th, to ditto ... is 185 da. ... 136„10 3„ 9„ 2
Sept. 16th, to ditto ... is 106 da. ... 275„15 4„ 0„ 1
13„ 3„

Cr. Side,

July 5th, to 31st Dec. is 179 da. on £198„10 is £4„17„ 4
Oct. 10th, till ditto is 82 da. ...... 145„15 1„12„ 9
Nov. 18th, till ditto is 43 da. ...... 126„ 0 0„14„10
7„ 4„11

Interest due by J. Austin £ 5„19„ 0*

Note. It is obvious that when the Account is long it must be very tedious without the assistance of *Tables of Interest*, from the number of calculations in ascertaining the interest on every Sum; to shorten the operation we may proceed as follows, which reduces the whole to one division.

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* For the mode in which the Interest is carried to an Account Current, and the Balance ascertained, see the Author's *Elements of Book-keeping* — INTRODUCTION.

Method 2.	Dr.	Cr.
May 15. To £182„ 0 for 230 da.	41860	
June 29. To 136„10 for 185 da.	25252	
Sept. 16. To 275„15 for 105 da.	29230	
July 5. By £198„10 for 179 da.	....	35531
Octr. 10. By 145„15 for 82 da.	....	11952
Nov. 13. By 126„ 0 for 43 da.	....	5418
Dr.	96342	52901
Cr.	52901	
Balance	43441	£5„19

The best method of computing interest on Accounts Current is the following: it is not only shorter and more expeditious, but exhibits the balances at the different dates, and reduces the whole to one calculation.

Rule. *Add and subtract the Sums on the Dr. and Cr. sides of the account in the order of their dates as they become due. Multiply the several balances by the days, and if the balance be sometimes due to one party, and sometimes to the other, extend the products in different columns. The difference of their sums divided by* 7300 *will give the interest.*

Method 3.

CALCULATION OF THE FORMER EXAMPLE.

May	15	To	182	″	″	45	8190
June	29	To	136	10	″		
			318	10	″	6	1911
July	5	By	198	10	″		
			120	″	″	73	8760
Sept.	16	To	275	15	″		
			395	15	″	24	9498
Oct.	10	By	145	15	″		
			250	″	″	39	9750
Nov.	18	By	126	″	″		
			124	″	″	43	5332

73.)434.41

Interest £5„19

Elucidation. Here the sums on either side of the Account are introduced according to the order of the dates. The sums on the *Dr. side* are added to the former balance, and those on the *Cr. side* subtracted. As the several sums are always in favour of A. B., one column only is necessary in extending the products, and which is summed up and divided by 7300 for the interest.

It is proper, before we find the number of days betwixt each transaction, to try if (£124) the last balance be the same as the balance of the Account, which will check the additions and subtractions; and before multiplying by the days, to try if (230) the sum of the column of days be equal to the number of days that intervene from (15th May) the date on which the Account commences to bear interest, to (31st December) the time to which the Account is brought up.

EXERCISES.

1. Required the Interest at 5 ℘ Cent., due on the following Account, up till 1st July.

Dr. Mr. A. Baines in Account Current with A. B. *Cr.*

Due.						Due.					
Feb.	4	To Rum	312	10	"	Mar.	20	By Bill	168	11	8
Mar.	12	To ditto	185	7	6	May	4	By Cash	150	"	"
Apr.	9	To Sugar	219	5	"	June	10	By Bill	197	10	"
May	15	To ditto	167	10	"						

2. Calculate the Interest on the following Account, up till 1st November.

Dr. M. E. Binn in Account Current with G. Wills. *Cr.*

Jan.	19	To Cotton	438	15	9	Jan.	1	By Balance	156	12	"
Mar.	12	To ditto	584	10	"		30	By Bill	260	"	"
May	25	To Ashes	290	12	3	Apr.	4	By Cash	430	"	"
July	7	To ditto	145	5	"	Aug.	21	By Calicoes	310	8	6

3. Find the Interest to the 31st December on the following current account, and ascertain the balance due.

Dr. Mr. R. Hill, his Account Current with W. Jones. *Cr.*

Aug.	1	To Goods	248	10	"	Aug.	31	By Cash	180	"	"
Sep.	19	To Cash	318	1	"	Oct.	5	By Bill	450	3	9
Oct.	3	To Insurance	31	19	7	Nov.	10	By ditto	305	10	10
	26	To Goods	246	17	6	Dec.	12	By Cotton	2436	9	11
Nov.	16	To Cash	330	"	"						

QUERIES.

1. What is Interest?
2. What is the principal?
3. What is the amount?
4. How much is the legal interest in Britain?
5. Is any other rate than 5 ℘ Cent. allowed in Britain?
6. When no rate of interest is mentioned, what rate is understood?
7. How do you calculate interest for years?
8. .... for months?
9. .... for days?
10. How do you calculate interest on a Debt where partial payments are made?
11. How do you calculate interest on Accounts Current?

DISCOUNTING BILLS.

To discount a Bill, means to procure *Cash* for it, before it becomes due; and a Bill is said to be discounted, when it is indorsed to any Person, or Banking Company, who pays the money, deducting the interest for the time it has to run.

CASE I. TO FIND THE INTEREST OR DISCOUNT ON A BILL FOR SO MANY MONTHS.

RULE. *Reckon a Penny for every month, as in* CASE II. *of interest, or consider the Sum in Pounds, as many shillings, as method 3d, of* CASE III.

Ex. I have two bills, one of £90, at 2 months' date; the other of £80, at 3 months. How much do I pay for discount?

£90, is 7/6 for one mo. for 2 mo. £0„15
80, is 6/8 for ditto, for 3 mo. 1„ 0
Answ. The discount is £1„15

EXERCISES.

1. What is discount on two bills of £65, the one at 3 months, and the other at 4 months' date?

2. How much Cash should I receive from a Banker, who discounts me the following bills?

3 Bills of £39, for 1, 2, and 3 months' date.
2 Bills of £67„10, at 2, and 4 months.
1 Bill of £130, at 3 months.

CASE II. TO FIND THE DISCOUNT ON A BILL WHEN THE TIME IS RECKONED IN DAYS.

RULE 1. *If the time is mentioned which the bill has to run; compute by* CASE II. *of interest.*

2. *If the number of days is not given; reckon from the time the bill was discounted, till the day on which it is payable, (which is three days beyond the term of the bill,) then compute the interest for that time.*

Note. To find the proceeds of a bill, deduct the discount from the sum of a bill.

EXAMPLES.

1. What is the discount on a bill of £150, that has 60 days to run?

£ 150
60 da.
73.)90.00
1.232 = £1„4„8 Ansr.

2. Required the proceeds of a bill of £580, dated 9th April, at 4 months, and discounted on the 14th May?

A bill drawn 9th April, at 4 mo., is due $\frac{9}{12}$ August.
From 14th May, when discounted, till 12th August, is 90 days.

£580	Bill ... £580
90	Discount 7„3
73.)522.00	Proceeds £572„17
£ 7„3	

EXERCISES.

1. How much should I pay for getting the following bills discounted? £146 for 50 days, £182„10 for 60 days, and £365 for 91 days.

2. How much discount should a Banker take for advancing money, on a bill of £1209 for 57 days?

3. Required the proceeds of a bill for £390, dated 11th Sept., at four months, and discounted 17th October?

4. Required the proceeds of a bill of £198„15, drawn and discounted 7th Jan. à 3 months?

5. The following bills were discounted, on the 10th Oct., viz.

A. B.'s bill ℘ £362„10, due 7th Jan.
C. D.'s .... 295„12, ... 9th do.
E. F.'s .... 143„ 5, ... 12th do.

How much do the proceeds of each bill amount to?

Note. The foregoing method of calculating discount on Bills is always used in business, and it may here be observed, that in the purchase and sale of Goods, the general practice is to allow the Purchaser, on paying cash, double interest for the length of credit. Thus, if the Goods are sold at three months, 2½ ℘ Cent. is taken off the account, and if the credit be 6 months, 5 ℘ Cent. is deducted.

We shall here, however, subjoin the Rule for finding the *true discount*, and present value in cash of any sum due at a future period, which on some occasions is useful.

RULE. *As* £100, *with its interest added for the given time; is to its interest, so is the Sum given to the true Discount.*

Or, as 100 *with its interest, for the given time, is to* 100, *so is the Sum given to the present value.*

EXERCISES.

1. How much money at present is equivalent to receiving £520 at the end of 292 days?

2. What sum lent at 5 ℘ Cent. for a year would produce £1000?

3. A. borrows a certain sum at 5 ℘ Cent.; at the end of 12 months he pays £1050, which is in full of principal and interest: how much was the sum lent?

4. A person agrees to advance money on a bill of £830, due in 9 months, on being allowed interest only on the sum he pays: how much discount shall he receive?

QUERIES.

1. What is meant by discounting a Bill?
2. How is this done?
3. How do you calculate the discount?
4. How do you find the proceeds?
5. How do you find the present value of any sum due at a future period?

EQUATION OF TIME.

Equation of Time is to find the average or medium time at which two or more Sums, due at different dates, may be paid at once.

Rule. *Multiply each Sum by the time it has to run, (computing from the date of the first,) and divide the sum of the products by the amount of the debt: the quotient gives the average or equated time of payment.*

EXAMPLES.

1. At what date will £150 due 2d May, £175 due 1st June, and £262.10 due 2d August, average?

May 2d. £150
June 1st.... 175 ×30= 5250
Aug. 2d.... 262.10×92=24150
587.10 588)29400
50 days from 2d May or 21st June.

2. Bought goods payable at the following dates: — £89 due 1st March, £72 on 10th May, £45 on 4th July, and £54 on the 10th August. When is the medium for settling the whole?

March 1st....£89 at this date.
May 10th.... 72×70 da. = 5040
July 4th....... 45×125 = 5625
Aug. 16th.... 54×168 = 9072
260 260)19737(76 days after 1st March, or 16th May. Ans.

EXAMPLES.

1. On what day are the following Sums due at an average, viz. £50 due 11th January, £30 due 28th do., £80 due 3d February, £90 due 13th do., and £40 due 28th March?

2. £95 is due as follows: — £25 in 6 months, £30 in 7 months, and £40 in 10 months. At what time ought the whole to be paid at once?

3. Purchased goods on the following terms: — One-third in Cash, one-third in 6 months, and the remainder in 9 months. Required the average credit?

4. Sold a lot of goods on the 4th May, and the buyer was to pay one-fourth of the amount every 3 months. At what date should I take his note for the whole?

5. A debt of £400 is to be paid as follows: — One-fourth at 8 months, one-fourth at 12 months, and the balance in 15 months. Required the time for paying the whole at once?

6. A person owes £1000; one-fourth of it due at Lady-day, one-fourth at Midsummer, one-fourth at Michaelmas, and the balance at Christmas. At what time does it fall due at an average?

7. An agent sells goods to his employer payable at the following dates: — £52.10 due 7th January, £67.9 due 29th do., £36.18 due 12th February, £29.12 due 1st March, and £43.7 due 31st do. Required the average time of payment?

QUERIES.

1. What is Equation of Time?
2. How do you find the average time?

INSURANCE.

Insurance, or Assurance, is a contract of indemnity, by which one Party engages, for a stipulated sum, to insure another Party against a risk to which he is exposed.

The Party who takes upon him the risk is called the *Insurer, Assurer*, or *Underwriter*, and the party protected by the insurance is called the Insured, or Assured; the sum paid is called the *Premium*, which is generally at so many guineas ℘ Cent.; and the paper or parchment containing the contract is called the *Policy*.

Note. The stamp-duty on policies of insurance from one part of the United Kingdom to another, is 2/6 ℘ Cent., and on any part of £100, upon every other policy, it is 5/. ℘ Cent.; but brokers in London generally charge 5/3 for Foreign Policies, which is 5 ℘ Cent. or one year's interest on the 5/.

Covering Property is when the value of the cargo with the premium and other charges are also insured.

Average is a contribution made at Sea, and is distinguished into general and particular averages.*

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* *General Average* is a proportionable contribution paid by all the proprietors of a ship, freight, and cargo, for losses which are made with a view to safety; such as throwing goods overboard, or cutting away masts to prevent shipwreck; but voluntary sacrifices

CASE I. TO CALCULATE THE PREMIUMS.

RULE. *Calculate as in Commission, and if the rate be given in guineas, add $\frac{1}{20}$th to the result.*

Ex. 1. Find the premium on £1785 @ 3¾ guineas ℘ Cent.

Method 1.

1785 @ 3¾ gs.
3
¼... 5355
1338.75
66.3975 = £66„18„ 9
add $\frac{1}{20}$ 3„ 6„11¼
Ans. £70„ 5„ 8¼

Method 2.

$\frac{1}{40}$ | 178.5
½ | 44.625
22.3125
66.9375 = £66„18„ 9
add $\frac{1}{20}$ 3„ 6„11¼
£ 70„ 5„ 8¼

Method 3.

$\frac{1}{20}$...178.5 at 3¾ guineas
off ½ ... 89„ 5„ 0 = 5 ℘ Cent.
22„ 6„ 3 = 1¼ off.
add $\frac{1}{20}$ 66„18„ 9 = 3¾ ℘ Cent.
3„ 6„11¼
£ 70„ 5„ 8¼

Ex. 2. What is the cost of an insurance effected on £1050, at 7 gs. ℘ Cent. on goods from Oporto to London, policy 5/., and commission ½ ℘ Cent. ?

10.50
7
$\frac{1}{20}$ 73.50
3.675
77.175 = £77„ 3„ 0 Premium.
5/. × 11* = 2„15„ 0 Policy.
½ of 10.50 = 5„ 5„ 0 Commission.
£ 85„ 3„ 0 whole Cost.

EXERCISES.

1. What Sum will it cost to insure £600 at 1¼ guineas ℘ Cent., stamp duty 2/6 ℘ Cent. ?

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of this kind must be made by the previous consultation of the Officers and Sailors.

Particular Average is a contribution made by the underwriters, for such damages or losses as may happen from the common accidents of the sea; and which must be sustained or paid by the proprietors of the article that suffers the damage.

* The policy stamp is always charged on even hundreds; that is, £10,50 requires a stamp for £11,00.

2. What is the cost of insuring £1625 on goods to Jamaica, premium 8 guineas ℘ Cent., policy 5/3, and commission ½ ℘ Cent.

3. Find the cost of insuring £1950 on goods from London to Bristol, at 3¾ guineas, policy 2/6, and commission ½ ℘ Cent.

4. How much will it cost to insure £1375 on goods from Quebec to Ireland, at 5 guineas, policy 5/3, and commission ½ ℘ Cent.?

CASE II. TO FIND THE AMOUNT TO BE INSURED TO INCLUDE A GIVEN SUM, AND THE COST OF INSURANCE.

RULE. *Add together the rate of the premium, policy, and commission; subtract this sum from £100, and say, As the remainder is to £100, so is the given sum to the amount to be insured.*

Exam. What Sum must be insured to cover £2130, premium 10 guineas, policy 5/., commission ½ ℘ Cent.?

Premium	£10„10„ 0
Policy and Com.	0„15„ 0

100 — 11„ 5„ 0 = 88„15 : 100 :: 2130
100

88.75)213000(2400 £
17750
35500
35500
00

Proof.		
	Sum insured for	£2400
	Prem. on £2400 at 10 gs.	£ 252
	Policy 5/. ℘ Cent.	6
	Commission at ½ ℘ Cent.	12
	deduct	£ 270
	Amount to be covered	£2130

EXERCISES.

1. Find what Sum should be insured to include £469„10, at 5 guineas ℘ Cent., policy 5/., commission ½ ℘ Cent.

2. Find what amount should be insured to cover £687 at 8 guineas ℘ Cent., policy 5/3, commission ½ ℘ Cent.

3. How much will cover £1560 and the cost of insurance, at 9 guineas ℘ Cent., policy 5/6, commission ½ ℘ Cent.?

CASE III. TO FIND THE NET COST OF AN INSURANCE, WHEN THERE IS A RETURN OF PREMIUM ALLOWED.

RULE. *Find the full cost of the Sum insured as before, and from the amount deduct the return ℘ Cent.*

Note. In the questions which follow, policy duty 5/., and commission at ½ ℘ Cent., is understood to be added in the calculations.

Exam. How much must be paid for insuring £2000 from Jamaica to London, at 12 guineas ℘ Cent., with a return of 5 ℘ Cent. for convoy and arrival? The vessel sailed with convoy, and the *goods arrived safe.*

£12.12		20,00
20,00		5
£252	Premium.	£100
5	Policy 5/. ℘ Cent.	
10	Commission.	
£267	Cost of insuring £2000.	
100	Amount of return for convoy, &c.	
£167	Net cost of the insurance.	

EXERCISES.

1. Calculate the full and net premium on £2375 at 10 guineas ℘ Cent., to return 5 ℘ Cent. for convoy and arrival, which took place.

2. Find the cost of an insurance on £3000 at 5 guineas ℘ Cent., to return 2½ ℘ Cent. for convoy and arrival, which took place.

3. What is the net cost of an insurance effected on £1200, at 6 guineas ℘ Cent., on goods from Stockholm to Plymouth, to return 2 ℘ Cent. if the vessel departs from the Sound with convoy for the Downs, and 1 ℘ Cent. more if with convoy from thence for the voyage and arrival, which took place?

CASE IV. TO COMPUTE AVERAGE LOSSES.

RULE. *As the whole value of any article is to the whole loss, so is each person's share of that article to his proportional average of the loss; or so is £100 to the average loss ℘ Cent.*

Note. In computing a general average for masts, rigging, &c. cut away, a deduction is made of ⅓ from the cost of replacing them, as the new articles are supposed to be so much better than the old; but goods thrown overboard are valued at the sum they would have brought, had they arrived safe.

Exam. A ship has arrived at Liverpool with considerable damage, having in a storm been obliged to cut away masts, rigging, &c., cost of replacing which is £720; the value of the ship is £2200; amount of the cargo on board £6400, but only to the value of £4800 insured; freight £1200, of which deduct £200 for vessel expenses required the general average loss ℘ Cent., and how much each party will sustain?

CALCULATION.

Cost of replacing masts, rigging,	£720	
Deduct ⅓ for tear and wear,	240	
Amount of general average loss,		£480
The value of the Ship,		£2200
Cargo insured to the amount of		4800
—— not insured,		1600
Freight,	£1200	
Deduct for expenses,	200	
		1000
Value of the Ship, Cargo, and Freight,		£9600

Value. Damage. £
Then, As 9600 : 480 : : 100 : 5 ℘ Cent., average loss.

Answer.	The owners of the ship (if not insured) therefore sustain a loss on .... £3200 @ 5 ℘ Cent. ...	£160
	Underwriters pay on ...... 4800 at do.	240
	Proprietors of the goods, on 1600 at do.	80
	Amount of the loss as above, ...	£480

EXERCISES.

1. An average loss of £312.10 was incurred on a Policy of £5000: required the loss ℘ Cent.?

2. A ship from Jamaica to London suffered in the course of her voyage the following damages: masts, cables, &c. cut away, £450; an anchor lost, value £50; 10 puncheons rum thrown overboard, value £200; sundry charges of pilotage, £50: Of 180 hhds. of sugar on board, a part was so much damaged, that the deficiency of 45 hhds. on a comparison with the 135 that arrived free of damage, was 22½ hhds., insured at £25 ℘ hhd. The value of the ship is £5000, and cargo £8100; gross freight £2000; portage bill, &c. £100; premium of insurance 8 guineas, to return 3 ℘ Cent. for convoy and arrival, which took place. Required a statement of the general and average loss, and also the return of premium?

QUERIES.

1. What is Insurance?
2. Who is the Insurer or Underwriter?
3. What is meant by the premium?
4. What is meant by the policy?
5. What is meant by average?
6. What is a general average?
7. What is a particular average?
8. How do you calculate the premium?
9. How do you find how much will cover any sum?
10. How do you find the net cost of an insurance when there is a return of premium?
11. How do you compute average losses?

STOCK-JOBBING.

The Stocks, or Public Funds, are debts of Government created by loans, for which interest is paid from revenues set apart for the purpose.

The mode of raising supplies for the State, by borrowing money from individuals or Public bodies, and levying taxes for the payment of the interest, is called the *Funding System*, and the loans thus raised constitute the *National Debt.*

Note. In the following calculations every Purchase or Sale of *Stock is considered to* be made through the medium of a Broker, who receives $\frac{1}{8}$ ℘ Cent., or 2/6 on every £100 of stock, which is *added* to the cost of a *purchase*, but *deducted* from a *sale* of Stock.

Case I. To Find the Cost of any Quantity of Stock.

Rule. *As £100 Stock is to the current price of £100, so is the quantity of stock to the cost.*

Or, Multiply the price of the stock by the quantity, and divide by 100.

EXAMPLE.

Find the cost of £800 Three ℘ Cent. Consols, purchased at $72\frac{5}{8}$ ℘ Cent.

100 : $72\frac{5}{8}$ :: 800			or,	72.625	
8				800	
£581	Value.			£581.	Purchase.
1	Brokerage.			. 1	Brokerage.
£582	Answ.			£582	as before.

Note. By adding $\frac{1}{8}$ to the rate for the brokerage, the result will give the whole cost or answer. Thus in the above Ex. $72\frac{5}{8}$ and $\frac{1}{8}$ = $72\frac{3}{4}$, which multiplied by 800 = £582.

Remarks. 1st. The different Funds are distinguished according to the terms on which they were established. Thus, some are called the *Three ℘ Cents*, some the *Four ℘ Cents*, and some the *Five ℘ Cents ;* and the manner of buying stock is to give a specific sum for a nominal one. If, for example, the price of the *Three ℘ Cents* be @ 60, it is paying £60 for £100 stock, and yields a dividend of £3 a year, which is 5 ℘ Cent. interest on the £60 laid out. The same interest accrues in the *Four ℘ Cents* at 80, and in the *Five ℘ Cents* at 100. It may, however, be observed, that the interest in the different Funds is not always equal, the time of paying the dividends makes a difference, and a preference is likewise given to that stock which is most marketable, and the least liable to be redeemed by Government.

2d. The term *Stock* is likewise applied to the Capitals of the Bank of England, and of the East India and South Sea Companies, &c. These stocks are transferable like the Government Funds, but the dividends vary according to the success of the respective Companies.

3d. The Debts of Government differ from other Contracts, inasmuch as the public Creditor or Stock-holder can only claim his interest; he may, however, sell his Stock, that is, he may transfer his claim to any other person, and thus obtain his capital more or less, according to the price of Stock, which fluctuates from a variety of causes.

EXERCISES.

1. Find the proceeds of £625 Stock, sold @ 62$\frac{3}{8}$ ℘ Cent.

2. Find the cost of £1250, Four ℘ Cents, @ 79$\frac{1}{4}$ ℘ Cent.

3. What cost £1500 Stock in the Three ℘ Cents, bought @ 61$\frac{1}{8}$ ℘ Cent.?

4. What cost £185 Stock in the Navy Five ℘ Cents, purchased @ 95$\frac{3}{8}$ ℘ Cent.?

5. What is the difference on £1800, Three ℘ Cent. Consols, bought @ 62$\frac{3}{8}$, and sold @ 65$\frac{1}{4}$.?

6. A. employed a Broker to purchase for him £7000 Stock in the Four ℘ Cents @ 71$\frac{1}{4}$, and some time after the Broker informs A. that Stocks had fallen to 71$\frac{3}{8}$, who orders him to sell out. Required the loss attending this transaction.

7. How much are the proceeds of £68 Long Annuity, sold @ 18$\frac{3}{16}$ years' purchase?

8. What is the cost of an Imperial Annuity of £75, bought @ 7$\frac{1}{4}$ years' purchase?

CASE II. TO FIND WHAT QUANTITY OF STOCK A GIVEN SUM WILL PURCHASE.

RULE. *Add or subtract* $\frac{1}{8}$ *to or from the given rate, according as the Stock is bought or sold; then as the sum or remainder is to* £100, *so is the given Sum to the quantity of Stock.*

Or, Multiply the sum to be laid out by 100, *and divide the product by the rate as above, the quotient is the answer.*

EXAMPLES.

How much Stock, in the Three ℘ Cents at 72$\frac{5}{8}$, will £582 purchase?

$$
\begin{array}{rrl}
 & 72\frac{5}{8} & \\
\text{Com.} & \frac{1}{8} & \\
\hline
72\frac{3}{4} : & 100 & : : \text{£}582 \\
4 & 4 & \quad 400 \\
\hline
291 & 400 & 291)232800(800\text{£ stock.} \\
 & & \quad 2328 \\
\hline
 & & \quad\ \ 00
\end{array}
\qquad
\begin{array}{r}
\text{or, £}582 \\
100 \\
\hline
72.75)58200 \\
\hline
\text{£}\ \ 800
\end{array}
$$

EXERCISES.

1. What quantity of Stock at 62$\frac{1}{4}$ ℘ Cent. can be bought with £350?

2. What quantity of Stock @ 71$\frac{3}{4}$ ℘ Cent. must be sold to produce £1148?

3. A person has £1000 to invest in the Four ℘ Cent. Consols, which are at 80$\frac{7}{8}$; for what Sum must he give an order to his Broker, so that, including his Commission, it may cost just the sum he has to lay out?

4. If an annuity of £450 produced by Stock in the Three ℘ Cent. *Consols were* sold at 66$\frac{5}{8}$; how much Stock in the Navy Five ℘ Cents *at 97$\frac{3}{4}$ could be purchased* with the net proceeds?

CASE III. TO FIND WHAT SUM MUST BE LAID OUT IN THE PURCHASE OF STOCK TO PRODUCE A CERTAIN INCOME.

RULE. *As the rate of interest which the stock yields is to £100, so is the given income to the quantity of stock to be purchased; and then find the cost of the stock.*

Note. When the property-tax*, which is 10 ꝑ Cent., is taken into consideration, ⅛ must be added to the given income.

EXAMPLES.

What sum must be laid out in the Three ꝑ Cents. Reduced @ 61⅛ ꝑ Cent., to produce a net income of £150.

Add ⅛ | £150„ 0„0 Net income.

| 16„13„4 Tax 1/10 of gross income.

3 : 100 : : 166„13„4 gross income.

100

3)16666„13„4

£ 5555„11„1 Stock to be purchased.

Then to find the cost of the stock.

¼ …… 5555.55 @ 61¼ including brokerage.

61¼

5555.55

333333.0

1388.88

3402,77.43=£3402„15„6 Answ.

EXERCISES.

1. How much money must be laid out in the Imperial Three ꝑ Cents., @ 63¾, to produce a net income of £250?

2. How much money must be laid out in the Irish Five ꝑ Cents., @ 97½, to produce a gross income of £300?

3. If £4732„10, in the Three ꝑ Cents. be sold out @ 64¼, what sum will it require, in addition to the net proceeds, to procure a net income of £200?

CASE IV. TO FIND THE RATE OF INTEREST WHICH MONEY PRODUCES IN THE STOCKS.

RULE. *As the given price or value of £100 is to the rate ꝑ Cent. so is £100 to the rate of interest which the money yields.*

EXAMPLE.

Find the rate of interest that is made of money laid out in South Sea Stock, @ 71¾, the yearly dividend being 3½ ꝑ Cent.?

Price. Interest. £

If 71¾ : 3„10 : : 100

100

71.75)350.00

£ 4„17„6 or 4⅞ ꝑ cent. Answ.

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* This tax has been taken off since the work was written.

EXERCISES.

1. If the Four E Cent. Consols sell @ 81¾, what rate E Cent. interest is made of money laid out in that stock?

2. At what rate can a person purchase in the Three E Cent. Consols, to have 5⅛ E Cent. for his money?

3. A Stockholder wishes to know what rate of interest he has for his money in the Four ⅌ Cents, when they are 82½.

QUERIES.

1. What are the STOCKS or Public Funds?
2. What is meant by the Funding System?
3. How are the different Funds distinguished?
4. Is the term *Stock* never applied but to the debts of Government?
5. In what respects do the debts of Government differ from other contracts?
6. How is Stock generally transferred?
7. How do you find the cost of any quantity of Stock?
8. How do you find what quantity of Stock a given sum will purchase?
9. How do you find what sum must be laid out in the purchase of Stock to produce a proposed income?
10. How do you find the rate of interest which money produces in the Public Funds?

GAIN AND LOSS.

THIS Rule is used by Merchants in calculating how to rate their goods, so as to gain or lose so much ⅌ Cent. It is only an application of the Rule of Proportion.

CASE I. TO FIND THE GAIN OR LOSS ⅌ CENT.

RULE. *As the prime cost is to the sum gained or lost, so is £100 to the rate ⅌ Cent.*

EXAMPLES.

1. Bought wool @ 3/4 ⅌ lb. and sold it for 4/. Required the gain ⅌ Cent.?

By the Rule.

If 40d. : 8 : : 100
5 1 20 ⅌ Cent.

Abridged by 8.

Or practically thus:

8d. is ⅕|100
20 ⅌ Cent.

2. Sold cloth @ 9/7 ⅌ yard, which cost me 10/5. Required my loss ⅌ Cent.?

10/5 = 125d. : 10 : : 100
5 4 4
5)40
Ans. 8 ⅌ Cent. loss.

EXERCISES.

1. Sold muslins @ 2/9¾ ℘ yard, which cost me 2/6; what did I gain ℘ Cent.?

2. Bought cloth @ 6/8 ℘ yard, but, being damaged, I was obliged to sell it at 6/3; what was lost ℘ Cent.?

3. Purchased cambrics @ 4/8 ℘ yard, which I sold for 5/3; how much ℘ Cent. had I?

4. A grocer sold coffee @ 2/4 ℘ lb. which cost 2/8; how much did he lose ℘ Cent.?

5. Bought a Property for £420, and sold it immediately for 30 guineas profit. Required my gain ℘ Cent.

CASE II. TO FIND THE PRICE AT WHICH AN ARTICLE SHOULD BE SOLD TO GAIN OR LOSE SO MUCH ℘ CENT.

RULE. *As 100 is to 100, with the proposed gain added to it, or loss deducted from it, so is the prime cost to the required price.*

Or, *Take parts of the prime cost for the rate ℘ Cent.; add the result in case of gain, but subtract it in case of loss.*

EXAMPLES.

1. Bought wool @ 3/4 ℘ lb.; at what must I sell it to gain 20 ℘ Cent.?

100
20
If 10,0 : 12,0 : : 3/4
3⅓ sh.
36
4
10)40
Ans. 4/. ℘ lb.

Or, *By Table I.*
℘ Ct.
20 = ⅕ | 3/4
| .8
4/. as before.

2. At how much must I sell sugar ℘ Cwt., which cost me 5 guineas, to lose 20 ℘ Cent.?

100
20
100 : 80 : : 105
5 4 4
Abridg. by 20. 5)420
Ans. 84/. ℘ cwt.

Or, *By Table I.*
off ⅕ | 105/.
| 21
84/. as before.

EXERCISES.

1. Gained 12½ ℘ Cent. on cloth which I bought for 7/6 a yard; at what did I sell it?

2. Bought superfine cloth at 31/6 ℘ yard, which, being damaged, I lost 12½ ℘ Cent. by the sales; at what price ℘ yard was it sold?

3. How much must sugar, which cost 79/4 ℘ Cwt. be sold for, to produce a profit of 12½ ℘ Cent.; and how much a lb. to yield 3d. ℘ shilling?

4. Sold a lot of Goods @ 7½ ℘ Cent. profit, by which I cleared £54„12; how much did the goods cost me?

CASE III. TO FIND THE PRIME COST.

RULE. *As 100, with the gain ℘ Cent. added to it, or loss subtracted from it, is to 100, so is the price for which the article was sold to the prime cost.*

EXAMPLES.

1. Sold wool at 4/. ℘ lb., by which I gained 20 ℘ Cent.; required the prime cost.

If 12,0 : 10,0 :: 4.
4
12)40
Ans. 3/4 ℘ lb.

Or, *By Table II.*
4/.
deduct ⅙ 8
as before 3/4

2. By selling sugar @ 84/. ℘ Cwt., I lost 20 ℘ Cent.; at what price did I purchase?

If 8,0 : 10,0 :: 84/.
10
8)840
Ans. 105 ℘ cwt.

Or, *By Table III.*
84/.
add ¼ 21
as before 105/.

EXERCISES.

1. By selling linen @ 3/. a yard, the merchant cleared 12½ ℘ Cent.; how much did it cost him?

2. Sold cloth @ 15/. a yard, by which I lost 10 ℘ Cent.; at what price was it bought?

3. Sold port wine @ 80 guineas ℘ pipe, and gained 25 ℘ Cent. by the sales: required the prime cost.

4. A merchant, by selling fancy prints @ 3/6 ℘ yard, clears 20 ℘ Cent.; required his invoice price.

CASE IV. TO FIND A PROPORTIONAL RATE ℘ CENT. ON AN ADVANCED PRICE.

RULE. *As the price whose rate ℘ Cent. is given, is to 100, with the gain added, or loss subtracted, so is the given price to a fourth number, which, if greater than 100, the difference shows the gain; and if less, the loss ℘ Cent.*

EXAMPLES.

1. Sold rum @ 17/6 ℘ gallon, and cleared 10 ℘ Cent.; required my profit ℘ Cent. by selling it at a guinea?

As 17/6 : 115 : : 21/.
sixp. 35   6   42 sixp.
5   )960   6

Abridged by 7. From 138 — 100=38 ⅌ Cent. Ans.

2. A merchant sold cloth @ 13/4 a yard, and gained 12½ ⅌ Cent.? how much will he gain or lose if the price fall to 10/8?

13/4 : 112½ : : 10/8
40   4   32
5   )450   4

From 100 — 90=10 ⅌ Cent. loss, Ans.

Note. The first and third terms are reduced to *fourpences*, and then abridged by 8.

EXERCISES.

1. By selling brown sugar @ 8d. per lb., I gain 10 ⅌ Cent.; how much ⅌ Cent. will I gain @ 10½ ⅌ lb.?

2. Sold tea @ 6/8 ⅌ lb., and lost 12½ ⅌ Cent. by the sales; how much will I lose or gain ⅌ Cent. by selling @ 8/4?

3. By selling superfine cloth @ 28/. a yard, I lose 15 ⅌ Cent.; but markets rising, I sold the rest of the piece @ 32/. ⅌ yard; whether did I gain or lose by the latter price, and how much ⅌ Cent.?

4. A grocer sells tea @ 7/6 ⅌ lb., and gains 10 ⅌ Cent.; how much will he gain ⅌ Cent. should the price rise to 8/9; and how much will he lose if it fall to 7/.?

PROMISCUOUS QUESTIONS.

1. If 1½d on a shilling be a Merchant's profit, what is that ⅌ Cent., and to what extent must he deal to gain £900 ⅌ annum?

2. A Grocer bought a quantity of sugar @ 84/. ⅌ Cwt.; at what price should he rate it ⅌ lb. to gain 2d. on the shilling, and at what ⅌ Cwt. to gain 12½ ⅌ Cent.?

3. Bought Dutch linen @ 2/3 by the Flemish ell of 3 qrs.; how must it be sold by the yard to gain 3d. on the shilling?

4. Sold cloth @ 25/. ⅌ yard, and gave 6 months' credit, which I bought for 20/. at 12 months: required the gain ⅌ Cent.

5. Purchased goods @ 9 months, and sold them immediately at the Invoice price for *Cash;* required the gain ⅌ Cent. allowing money to be worth 10 ⅌ Cent. ⅌ annum?

6. Three Shopkeepers rate their goods as follows: — A. charges 2½d. on the shilling; B. 3/6 ⅌ pound; and C. buys @ 12/6 and sells at 15/. How much ⅌ Cent. of profit do each of them take?

7. A Merchant buys cloth @ 15/. a yard: how much must he sell it to have a profit of 15 ⅌ Cent., and allow 10 ⅌ Cent. discount for cash?

8. A Corn-dealer purchases barley @ 38/. ⅌ quarter; how must he sell it to gain 12½ ⅌ Cent., and allow the purchaser a discount of 5 ⅌ Cent.?

9. Sold a hogshead of sugar for £50, on which I lost 2d. ⅌ lb.,

whereas at 2d. ℘ lb. profit I should have cleared £14„11„8: how many lbs. did the hhd. weigh, and how much ℘ Cwt. did I lose?

10. Bought a quantity of coffee, for £80„17, and after keeping it on hand for 9 months was obliged to sell it at 2/3 ℘ lb., though it cost me 14 guineas ℘ Cwt.: required the number of lbs. sold, and my loss ℘ Cent. including interest?

I. Table of Profit and Loss ℘ Cent.

For	$2\frac{1}{2}$ ℘ Cent.	which is 6d. ℘ £	....	$=\frac{1}{40}$.
......	$3\frac{3}{4}$ ℘ Cent.	...... is 9d. ℘ £	....	$=\frac{1}{40}$ and $\frac{1}{2}$.
......	5 ℘ Cent.	...... is 1/. ℘ £	....	$=\frac{1}{20}$.
......	$6\frac{1}{4}$ ℘ Cent.	...... is 1/3 ℘ £	....	$=\frac{1}{20}$ and $\frac{1}{4}$.
......	$7\frac{1}{2}$ ℘ Cent.	...... is 1/6 ℘ £	....	$=\frac{1}{20}$ and $\frac{1}{2}$.
......	$8\frac{1}{3}$ ℘ Cent.	...... is 1/8 ℘ £,	or 1d. ℘ shil.	$=\frac{1}{12}$.
......	10 ℘ Cent.	...... is 2/. ℘ £	....	$=\frac{1}{10}$.
......	$12\frac{1}{2}$ ℘ Cent.	...... is 2/6 ℘ £,	or $1\frac{1}{2}$d. ℘ shil.	$=\frac{1}{8}$.
......	15 ℘ Cent.	...... is 3/. ℘ £	....	$=\frac{1}{10}$ and $\frac{1}{2}$.
......	$16\frac{2}{3}$ ℘ Cent.	...... is 3/4 ℘ £,	or 2d. ℘ shil.	$=\frac{1}{6}$.
......	20 ℘ Cent.	...... is 4/. ℘ £	....	$=\frac{1}{5}$.
......	25 ℘ Cent.	...... is 5/. ℘ £,	or 3d. ℘ shil.	$=\frac{1}{4}$.
......	30 ℘ Cent.	...... is 6/. ℘ £	....	$=\frac{1}{5}$ and $\frac{1}{2}$.
......	$33\frac{1}{3}$ ℘ Cent.	...... is 6/8 £,	or 4d. ℘ shil.	$=\frac{1}{3}$.
......	50 ℘ Cent.	...... is 10/.℘ £,	or 6d. ℘ shil.	$=\frac{1}{2}$.

If a profit of $2\frac{1}{2}$ ℘ Cent. is to be laid on goods *add* $\frac{1}{40}$ part to the prime cost; or if a loss of $2\frac{1}{2}$ ℘ Cent. is to be sustained, *deduct* $\frac{1}{40}$; and so of the other rates.

II. Table for finding the prime cost when a certain profit ℘ Cent. has been added to the price.

If	$2\frac{1}{2}$ ℘ Cent.	deduct $\frac{1}{41}$.
...	5 ℘ Cent.	.... $\frac{1}{21}$.
...	10 ℘ Cent.	.... $\frac{1}{11}$.
...	$12\frac{1}{2}$ ℘ Cent.	.... $\frac{1}{9}$.
...	20 ℘ Cent.	.... $\frac{1}{6}$.
...	25 ℘ Cent.	.... $\frac{1}{5}$.
...	$33\frac{1}{3}$ ℘ Cent.	.... $\frac{1}{4}$.
...	50 ℘ Cent.	.... $\frac{1}{3}$.

III. Table for finding the cost when a certain loss ℘ Cent. has been sustained by the sales.

If	$2\frac{1}{2}$ ℘ Cent.	add $\frac{1}{39}$.
...	5 ℘ Cent.	...... $\frac{1}{19}$.
...	10 ℘ Cent.	...... $\frac{1}{9}$.
...	$12\frac{1}{2}$ ℘ Cent.	...... $\frac{1}{7}$.
...	20 ℘ Cent.	...... $\frac{1}{4}$.
...	25 ℘ Cent.	...... $\frac{1}{3}$.
...	$33\frac{1}{3}$ ℘ Cent.	...... $\frac{1}{2}$.
...	50 ℘ Cent.	*double the Sum.*

QUERIES.

1. What is the use of the rule of Gain and Loss?

2. How do you find the gain or loss ℘ Cent. on goods bought or sold @ certain prices?

3. How do you find the price at which an article should be sold to gain or lose so much ℘ Cent.?

4. How do you find the *prime cost* of goods which have been sold at a certain rate ℘ Cent. of gain or loss?

5. How do you find a proportional rate ℘ Cent. on an advanced *price?*

PARTNERSHIP.

Partnership is when two or more Persons unite in Trade, and agree to share the profits, or sustain the losses, arising from the Business, according to the terms of their Contract.

CASE I. WHEN THE PARTNERS ARE EQUALLY IN ADVANCE.

RULE. *Divide the gain or loss by the number of Partners.*[*]

EXERCISES.

1. Two Merchants in Co., A. and B. equally in advance, had funds to divide to the amount of £999.19.10; what falls to each?

2. Three Partners, A., B., and C., equally in advance, found upon balancing their books there was a net gain of £987.16.9 to be divided among them. What is the share of each, allowing A. 100 guineas as manager, besides his proportional share?

CASE II. WHEN THE COMPANY'S CAPITAL IS DIVIDED INTO A NUMBER OF SHARES.

RULE. *First, divide the proceeds by the number of shares, and then multiply the quotient by the number of shares each Partner holds.*

EXAMPLES.

The Capital of a Mercantile House is divided into 16 shares. A. holds 7 shares, B. 5, C. 3, and D. 1 share. The profit at the end of the year is £3727.10.8, and which is to be divided among the partners in proportion to the share they hold. How much will each draw?

A. ...... 7 shares
B. 5
C. 3
D. 1
16

$$16\left\{\begin{array}{l|l} 8 & 3727.10.\ 8 \\ \hline 2 & 465.18.10 \end{array}\right.$$

D.'s share £ 232.19. 5 × 3 × 5 × 7
C.'s 698.18. 3
B.'s 1164.17. 1
A.'s 1630.15.11
£ 3727.10. 8 Proof.

EXERCISES.

1. The Capital of a Trading Company is divided into 17 shares, of which A. holds 8, B. 6, and C. 3 shares: how is the net gain, which amounts to £959.11.7, to be divided among them?

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[*] This Case is so simple as not to require an example to illustrate the rule.

2. The profits of a Manufacturing House amount to £3900. There are four partners; A. holds $\frac{5}{13}$, B. $\frac{4}{13}$, C. $\frac{3}{13}$ and D. $\frac{1}{13}$: how much will each draw?

3. A. and B. engaged in Trade with a Capital of £4000; A. held 5 shares and B. 3 shares: at the end of the year their stock increased to £4894„17„6. Required each partner's share of the gain?

4. There are 3 Partners in a Concern; A. holds $\frac{7}{12}$, B. $\frac{3}{12}$, and C. $\frac{2}{12}$; A. becomes insolvent, by which there is a loss sustained to the amount of £296„15„10. Required what proportion of this sum falls to be paid by each of the solvent partners.

CASE III. WHEN EACH PARTNER IS TO SHARE IN PROPORTION TO HIS STOCK.

RULE. *As the whole is to the gain or loss, so is each Partner's stock to his share of the proceeds.*

EXAMPLE.

Three Persons engaged in a Speculation, on which there was a loss of £365„11: what proportion of this has each to bear, A. having advanced £400, B. £300, and C. £200?

A. …… £400
B. …… 300
C. …… 200
900

900 : 365„11 :: 400
4
9)1462„ 4
162„ 9„4 A. loses.

9,00 : 365„11 :: 3,00
3 £121„17 1
B loses.

9,00 : 365„11 :: 2,00
2
9)731„ 2
£ 81„ 4„8 C. loses.

Proof.		
	A. bears	£ 162„ 9„4
	B. ……	121„17„0
	C. ……	81„ 4„8
		£ 365„11„0

EXERCISES.

1. Two Persons entered into partnership; A. advanced £1200, and B. £900: they gained £301„17„6, which was to be divided in proportion to their stocks. Required how much each will draw of the profits?

2. Three Partners in Trade gain £787„10; A.'s stock was £3600, B.'s £1800, and C.'s £900: how is the gain to be divided proportionally among them?

3. A. with a Capital of £1200 entered into partnership with B. who brought into the concern £1500, and C. who advanced £2000. By bad debts they lost £1262„10, in consequence of which they

agree to dissolve the copartnership. Required the sum with which each partner will retire from the engagement, the loss being sustained in proportion to their capitals.

CASE IV. WHEN THE PARTNERS ARE ALLOWED ONLY INTEREST FOR THEIR UNEQUAL ADVANCES.

RULE. *Subtract the amount of the interest of their several advances from the net profits on the business; then divide the remainder equally between the Partners, to which add the interest of the Capitals.*

EXAMPLE.

Three Persons join in trade: A. advances £300, B. £400, and C. £500: and it was agreed that each partner was to share equally of the proceeds, after allowing interest at 5 ⅌ Cent. ⅌ ann. for their unequal advances. Required the share of each, the gain at the end of the year being £165.

Solution.

Profit on the business £165.0.0
Interest on A.'s stock £300 is £15
———— B.'s do. 400 is 20
———— C.'s do. 500 is 25
—— 60.0.0
To be equally divided ... 105.0.0
One third is .... £ 35.0.0

A.'s $\frac{1}{3}$ is £35	B.'s $\frac{1}{3}$ is £35	C.'s $\frac{1}{3}$ is £35
Interest ... 15	Interest ... 20	Interest ... 25
A. draws £50	B. draws £55	C. draws £60

EXERCISES.

1. A., B., and C. enter into company on the 1st of January, 1816; A. advances £1200, B. £1500, and C. £1800. On the 1st of July, 1817, they balance their Books, and there is a net gain of £743.15 to be divided: how much will each partner draw, allowing interest at 5 ⅌ Cent. for their unequal advances?

2. A. and B. enter into partnership with a capital of £5000, of which A. advanced £2000, and B. £3000. At the end of 12 months, they agree to separate; and there appears a net gain of £687.10 to be divided. Required how much each will draw, according to their contract, which allows A. £125 ⅌ annum of salary for conducting the business, and legal interest on their unequal advances.

3. A. advances £2500 to carry on a branch of Trade; B., his Partner, has no money, but a thorough knowledge of the business, and who is to conduct it. By the terms of their Contract, A. was to be allowed 8$\frac{1}{3}$ ⅌ Cent. for the interest of his money and risk; and the profits are to be divided in the proportion which the interest of A.'s money bears to B.'s former salary, which was £80: at the end of the year their net subject amounted to £3062.10. Required a division of the profits according to their Contract.

PROMISCUOUS EXERCISES.

1. A. began Business on the 1st of January, with a Capital of £1370; and on the 2d of April he took in B. as a partner, who put into the concern as much money as entitled him to share equally of the profits at the year's end. Required the sum he advanced.

2. Three Partners, who had been 4 years in business, found they had cleared £1160.15. They now wish to dissolve the copartnery, and settle their Accounts with one another. A. advanced £700 and has £500; B.'s capital was £600, and has drawn £450; C.'s £300, and has drawn £260. Required a state of their Accounts.

3. Two Persons unite in trade: A. advances £400, and as he is to manage the businsss, to be allowed 12 ℘Cent. for his money; B. advances £800, and to be allowed 8 ℘ Cent. At balancing their Books at the end of the year, there appears a net gain of £180.19. Required a division according to their contract.

4. Four Merchants enter into a partnership with a Capital of £3000; A.'s share is $\frac{1}{8}$, B.'s $\frac{1}{4}$, C.'s $\frac{1}{3}$, and D.'s the rest. When they strike a balance at the end of the year, there appears a loss of £196.12. D. being discouraged at the ill success, withdraws from the Copartnery, and the rest agree to advance his share of the proceeds, on being allowed a discount of 6$\frac{1}{4}$ ℘ Cent. Required how much D. will receive from each in proportion to their respective shares.

5. A. and B. enter into Company; A. advances £1000, and B. £500, whose services are to be estimated at £500 more. It is also agreed, that A. is to advance whatever money may be farther necessary to carry on the business, and to be allowed 7$\frac{1}{2}$ ℘ Cent. for it. A., at the end of 3 months, advanced £200 more; at the end of 6 months, £150; and at the end of 9 months, £300: they take a balance at the end of the year, and the net gain appears to be £450.10. Required the share of each Partner.

QUERIES.

1. What is Partnership?

2. When the partners are equally in advance, how is the gain or loss divided?

3. When the company's capital is divided into a number of shares, how are their shares ascertained?

4. When each partner is to share in proportion to his stock, how do you ascertain his proportion of the proceeds?

5. When each partner is allowed *only* interest for their unequal advances, how do you proceed?

BANKRUPTCY.

A **Bankrupt** is a Merchant or Banker, or any other Person in Trade, who cannot make good his payments, and has therefore a Commission of Bankruptcy taken out against him.

CASE I. TO FIND HOW MUCH A BANKRUPT'S SUBJECT WILL PAY PER POUND.

Rule. *As the amount of his Debts is to the Net Sum realised from his Estate; so is £1 to the Composition.*

EXAMPLE.

A Bankrupt owes to A. £326.15, to B. £218.10, to C. £375.5, and to D. £343.10; and the sum realised from his Estate is £610: How much will his Subject pay ℘ pound?

```
Debts Subject   £            | or, Decimally
 1464 : 610  : : 1           |  1464)610.0 (.416=8/4 ℘ £
        20                   |        5856
     ─────                   |       ─────
     12200(8/4 ℘ pound, Ans. |         2440
     11712                   |         1464
     ─────                   |         ────
       488                   |          9760
        12                   |          8784
     ─────                   |          ────
      5856                   |           976, &c.
      5856                   |          ════
     ═════                   |
```

EXERCISES.

1. A Merchant became bankrupt; his debts amount to £1567.10, and his Subject only to £744.11.3. How much can he offer his creditors ℘ pound?
2. I have a claim on a Bankrupt's Estate of £1135.10; his debts amount to £18723.7.6, and the net sum realised is £10531.15.9. How much will his Subject pay ℘ pound?
3. The state of a Bankrupt's affairs are as follows: — The amount of his debts £49756.10; he has Goods valued ℘ inventory £6275.10; due to him in open Accounts £11057.12.8, and in Bills to the amount of £4146.7.6, supposing the outstanding debts to be worth 15/ ℘ £, at an average, the goods to sell at a discount of 10 ℘ Cent., and the bills to be good. How much will his Estate pay ℘ pound allowing the Trustees 4 ℘ Cent.?

CASE II. TO CALCULATE HOW MUCH A CREDITOR WILL RECEIVE FOR HIS CLAIM AT A CERTAIN COMPOSITION OR DIVIDEND ℘ POUND.

Rule. *If the rate ℘ pound be an aliquot part, divide the sum by that aliquot part; if it be not an aliquot part, divide it into two or more aliquot parts, as in* CASE III. *of Practice.*

EXAMPLE.

How much will two dividends of 2/. and 8/9 ℘ pound amount to on a claim of £537″10?

2/.=$\frac{1}{10}$)537″10
Ans. £ 53″15

$\frac{1}{8}$)537″10″ 0
$\frac{1}{2}$) 67″ 3″ 9 =2/6 ℘ £
33″11″10½=1/3
Ans. £100″15″ 7½=3/9 ℘ £

EXERCISES.

1. Find how much three dividends at 2/6, 3/., and 4/6 ℘ pound, come to on a claim of £1120″16.

2. A dividend of 11/3 ℘ pound is to be paid on a claim of £965″10; how much will the creditor receive?

3. The composition of a Bankrupt is 12/6 ℘ pound; how much should a person receive for a claim of £1809″11″8?

4. A Bankrupt's debts amount to £13678″15, and his effects will pay 14/10 ℘ pound, which the creditors agree to receive in four dividends, as follows,—2/9, 3/6, 4/., 4/7. Required the sum of each establishment.

PROMISCUOUS EXERCISES.

1. A Person in business failed for a certain sum; his Creditors recovered £2942″10 from his subject, which paid them 12/6 ℘ pound. Required the amount of his debts and deficiency.

2. A Merchant became insolvent, and there was such a sum realised from his Estate as will pay his Creditors 8/9 ℘ pound; the amount of his debts is £20,450. Required the sum in the trustees' hands.

3. A Bankrupt offered his Creditors at present such a composition ℘ pound, as if improved at 10 ℘ Cent. ℘ annum, would amount to his Debt in 5 years. Required how much he offered to pay ℘ pound.

4. A. compounded a debt of £1450 at 12/6 ℘ £, with three years' interest at 5 ℘ Cent. on the composition, out of which he had lain 4 years and a half. Required his loss, supposing he could have improved his money at the rate of 7½ ℘ Cent. ℘ annum.

5. A Merchant being obliged to suspend his payments, offered his Creditors security to pay 20/. ℘ pound (without interest) in 4 years and a half; his subject will realise 13/4 in 9 months; now, allowing money to be worth 10 ℘ Cent. ℘ annum, should the Creditors agree to his proposal? and what is the difference to them, the amount of his debts being £39,500?

QUERIES.

1. What is a Bankrupt?

2. How do you find how much a bankrupt's subject will pay ℘ pound?

3. How do you calculate how much a creditor will receive for his claim @ a certain rate ℘ pound?

EXCHANGE.

Exchange teaches to compute how much money of one Country is equivalent to a certain Sum of another, at a given Course of Exchange.

Monies of Exchange and of Account are mostly the same: in some Places they are imaginary, for which there is no corresponding Coin: in other Places real, as shillings and pence.

The Course of Exchange is the quantity of the money of one Country, which is given for a fixed Sum of the money of another; the former is called the uncertain price, and the latter the certain price.

The Par of Exchange is the intrinsic value of the money of one Country, compared with that of another, both with respect to the weight and fineness.

The following Explanation of Lloyd's List, with the *Par*, *Usance*, and *Days of Grace*, with respect to London, may be useful to the Learner.

Places.	Par.	* Rate of Exchange.	Explanation.	Usance.	Days of Grace.
Amsterdam	36/1	34/4	shill. and pen. Fle. ꝑ £ ster.	1m/d.	6
Rotterdam .	11 F.	10.10	flor. and stivers cur. ꝑ ditto	1m/d.	6
Antwerp ...	11	10.10	ditto of Exch. ꝑ ditto	1m/d.	6
Hamburgh .	34/3	32/3	shill. and pence Flem. ꝑ ditto	1m/d.	12
Franckfort..	140	131	Batzen ꝑ £ sterling	14d/s.	4
Paris.........	25	21.80	francs and Cent. ꝑ ditto	30d/d.	10
Madrid......	39	40	pence ster. ꝑ dol. of Exch.	2/m.st.	14
Gibraltar....	34½	36	pence ster. ꝑ cur. doll.	2m/.st.	14
Leghorn.....	49	54	pence ster. ꝑ piastre	3m/d.	14
Genoa.......	45½	51	pence ster. ꝑ piastre	3m/d.	30
Venice......	26.30	22.80	Ital. livers ꝑ £ ster.	3m/d.	6
Malta........	53½	54	pence ster. for 30 tarins	30/d.s.	13
Naples......	42½	45	pence ster. ꝑ ducat	3m/d.	3
Palermo	124	128	pence ster. ꝑ oz.	3m/d.	—
Lisbon......	67½	68	pence ster. ꝑ milree	30d/d.	6
Rio Janeiro	67½	71	pence ster. ꝑ ditto	30d/d.	6
Dublin......	8⅓	10¼	£ or £110„5 Ir. for £100 ster.	*	3

* At so many days *after sight*, or *after date*, according to the rate of Exchange.

Agio is the difference between Bank and Current money; it also means, in those places where foreign coins are current, the difference between the actual value of such Coins, and that at which they have been fixed by Government.

Usance is the usual time at which Bills are drawn between certain Places; such as one, two, or three months after date; and *double* or *half Usances* mean double or half of the usual time. If the usance be one month, 15 days are allowed for half usance.

The following Rule will show when the Exchange is favourable, or unfavourable:—

The lower the course of Exchange runs, the more favourable it is to the Place or People in whose Money it is reckoned, and vice versâ.

I. WITH AMSTERDAM.

There are two kinds of Money in Holland, called *Banco* and *Currency*. The former generally bears a small premium, called *Agio*, and all Bills of Exchange are valued and paid in *Banco*.

Accounts are kept in *Guilders*, *stivers*, and *pennings*; and also in *Pounds*, *shillings*, and *pence*, Flemish.

16 Pennings = 1 Stiver. (2d. Flem.)
20 Stivers... = 1 Guilder or Flor.
2½ Guilders = 1 Rix-dollar,
6 Guilders = 1 Pound Flemish.

Also,
8 Penn. = 1 Groot or 1d. F.
12 Pence = 1 Shilling.
20 Shill. = 1 Pound.

Exchange with London, at so many Guilders or Florins, and shillings and pence Flemish for £1 sterling. *Par.* 36/1 *Flem.* ⅌ *£ Ster.*

To reduce Banco into Currency, and the contrary, say,
As 100 : *with the Agio added* : : *Banco* : *Currency.*
And 100 *with the Agio added* : 100 : : *Currency* : *Banco.*

EXAMPLES.

1. Reduce 1625 Guilders Banco into currency; agio at 3¼ ⅌ Cent.

Ban. Cur. Ban.
100 : 103¼ : : 1625
103¼
1677.8125
Or, 1677 guild. 16 stiv. 4 pen. cur.

Reverse statement for proof.
103¼ : 100 : : 1677.8125
413 400 400
413)671125.00000
1625 guild. ban.

2. Reduce 4066 Guilders 8 stivers into Sterling; exchange 10 florins or guilders, 8 stivers ⅌ £ Sterling. (= 34/8 Flem.)

Decimally.
guild. 10.4)4066.4(£391
312
946
936
104

g. st.
10,8)4066,8
20 20
208)81328(£391
624
1892
1872
208

Or, when the Exchange is given in Flemish, say

As 34/8 : 1£ :: 4066 : 8 : £391 as before.

For proof.

£391	Or,	⅕)391
10.4		10 : 8
1564		3910
391		78 : 4
		78 : 4
guilders 4066.4		guild. 4066 : 8 stiv.

3. How many Guilders currency in £850 sterling; exchange 36/4 Flemish ℘ £ sterling; agio 2½ ℘ Cent.?

£ ster. Flem. £ ster.
If 1 : 36.4 : : 850 : 9265 guilders banco.
ban. cur. banco. guild. stiv. ph.
Then, if 100 : 102½ :: 9265 : 9496„12„8 Answ.

EXERCISES.

1. Reduce 4420 Guilders banco into currency, agio 3⅛ ℘ Cent.
2. How much of a Debt in banco will 3852 Guilders 10 stivers currency compensate, agio 3¼ ℘ Cent.?
3. Reduce £586„10 Sterling into Dutch money, exchange at 10 florins 8 stivers ℘ £ sterling.
4. How much English money in 4588 Guilders 13 stivers 8 pen. currency of Holland; exchange 35/10 Flemish ℘ £ sterling, agio 4⅜ ℘ Cent.?
5. Amsterdam owes London £1704„5 Sterling; how much Dutch money is equal thereto, exchange 10 florins 6 stivers 4 pen. (=34/4¼ Flemish) ℘ £ sterling?
6. If the pay of a British sailor be £1„10 ℘ month, and that of a Dutch sailor 16 guilders, what is the difference, exchange 36/8?
7. What is the Course of exchange between Britain and Holland, when the bank guilder is at 22½d.?

II. With Hamburgh.

Money at Hamburgh is distinguished, as at Amsterdam, into *Banco* and *Currency*. The banco here bears a considerable premium; the agio being from 18 to 25 ℘ Cent., and all Bills of Exchange are valued and paid in this money.*

Accounts are kept in *Marks* and *shillings*, both banco and currency; also, in *Pounds*, *shillings*, and *pence* Flemish; but this is an imaginary money, and used only in Exchanges.

---

* Hamburgh money was formerly distinguished by the word *Lubs* (from Lubeck, the place of coinage); but this term, though still retained in books of exchange, seems out of use among men of business, the word *Hambro'* being substituted.

12 phennings = 1 shilling or sol.
16 shillings = 1 mark.
2 marks = 1 dol. of exch.
3 marks = 1 rix-dollar.
} Hambro', banco, and currency.

Also,

6 phennings = 1 groot or penny.
12 pencé = 1 shilling.
20 shillings = 1 pound.
} Flemish.

Hence, 6 shil. Ham. banco = 1 shilling Flemish.
3 marks banco = 8 shillings Flemish.
7½ marks = 20 shillings or £1 Flemish.

Exchange with London at a variable number of shillings Flemish for £1 sterling.* *Par.* 34/3 *Flem.* ℘ *£ Ster.*

EXAMPLES.

1. Reduce 3280 Marks banco into sterling; exchange 34/2 Flemish ℘ £ sterling.

sh. d. marks.
Ex. 34.2 3280
6 16 sh.
205) 52480)£256 ster.
410
1148
1025
1230
1230

£ st.
or, If 34/2 : 1 : : 3280 marks
12 32d. Flem.
410 6560
9840
41,0)10496,0(£256
82··
229
205
246
246

2. Reduce £256 Sterling into marks banco; exchange 34/2 Flemish ℘ £ sterling.

34s. 2d.
6
205
256 £
16)52480 shillings.
3280 marks.

sh. marks.
or, 20 : 7.5 : : 34s. 2d.
Abridged 4 1.5 1.5
4)51.25
Marks in £1. 12.8125
256 £
Ans. 3280 marks.

---

* The par between Hambro', banco, and currency, is reckoned at 23 ℘ Cent. Agio, or 13 marks *banco*, for 16 marks *currency*. The par between English money and Currency is 43/. Flemish for £1 sterling; but there can be no permanent *Par with banco*, because the Agio is fluctuating. If the agio be 23 ℘ Cent. £1 sterling equals 34/11¼; but by the estimate of Merchants, the par is from *34/7 to* 34/10, varying according to the price of gold and silver, and *the fluctuation of the* agio.

EXERCISES.

1. Reduce 6160 Marks current into banco, agio 18½ ℘ Cent.

2. How much Sterling money in 4162 marks 5 shillings banco at 33/10 ℘ £ sterling?

3. Reduce 17464 Marks current into sterling; exchange 34/5 Flemish ℘ £ sterling, agio 20 ℘ Cent.

4. London draws on Hamburgh for £1093„15 sterling; how many marks will pay the draft, exchange 34/9 Flemish ℘ £ sterling?

5. When the Course of exchange is 35/5 Flemish ℘ £ sterling, what is the value of the mark banco?

6. Required the Sterling value of the current mark, when the course of exchange between London and Hamburgh is at 33/4 Flemish ℘ £ sterling, agio 20 ℘ Cent.

III. With Paris.

Accounts in France are kept in Livres, sous, and deniers; and also in francs and cents.

12 deniers = 1 sou or sol.
20 sous = 1 Livre *Tournois*.
3 livres = 1 Ecu.

Also,

10 centimes = 1 decime.
10 decimes, or 100 cents = 1 Franc.*
80 francs = 81 Livres.

Thus the Franc, or new Livre, is equal to 243 deniers, being 1¼ ℘ Cent. better than the old livre tournois, which is 240 deniers.

Paris exchanges with London, by giving a variable number of francs and centimes for the pound sterling. *Par 25 Francs ℘ £ Sterling.*

To reduce francs, &c. into livres, &c. say,

As 80 : 81 :: francs : livres; or, add $\frac{1}{80}$.

EXAMPLES.

1. Reduce 3262 francs 50 Centimes into Livres.

add $\frac{1}{80}$ | 3262.5
40.78125
Livres 3303.28125

For proof.
3303.28125
80
81)264262.5
Francs 3262.50 Centimes.

---

* *Francs* and *Livres* were formerly synonymous, but in the Coinage of 1795 the 5 Livre Pieces were by some accident made too heavy, being worth 101¼ sous instead of 100. The new Franc has been therefore adopted in conformity to this accidental value; but, in the common course of business, *francs* and *livres* are still reckoned the same.

2. Reduce 7837 Livres 10 sous into sterling; exchange 23 livres 15 sous ℘ £ sterling.

£ s. Liv. Sous.
23.15 7837.10
20 20
475)156750
£ 330 sterling.

Reverse operation.
23.75 sous ℘ £
330 £
7837.5 Livres.

EXERCISES.

1. Reduce £364.7.6 into Francs and cents; exchange 23 livres 10 sous ℘ £ sterling.

2. How much Sterling in 9500 Livres 12 sous 6 deniers; exchange 24 francs 25 cents ℘ £ sterling?

3. How much English money in 2545 Francs 41 cents; exchange 24 francs 80 cents ℘ £ sterling?

4. How much English money in 3222 Livres 2 sous 9 deniers; exchange at 25 livres 14 sous ℘ £ sterling?

5. Reduce £364.7.6 into Francs and centimes; exchange 23 francs 50 centimes ℘ £ sterling.

IV. WITH MADRID.

Accounts in Spain are principally kept in Piastres, rials, and maravedis.

34 maravedis = 1 rial, or real.
8 rials = 1 Piastre, or Dollar.
4 piastres = 1 pistole of exchange.
375 maravedis = 1 ducat of exchange.

Exchanges between Spain and England are mostly negotiated by the piastre, also called pezza, dollar of exchange, and pieces of eight. The ducat is sometimes used in exchanges, as also the pistole.* *Par 39d. Ster. ℘ dollar.*

EXAMPLES.

1. Reduce 3760 piastres 6 rials into sterling; exchange 35d. ℘ piastre.

$\frac{1}{16}$, $\frac{1}{12}$)3760.75
313.3958 = 20d.
235.0467 = 15d.
548.4425 + = £548. 8.10

---

* The money of Spain is distinguished into plate and vellon; the *former is to the* latter as 32 to 17, that is, 32 rials vellon is equal to *17 rials of plate.* In exchanges with England, plate only is used. A

2. Reduce 64320 Rials vellon into sterling; exchange 34½ ℘ piastre of plate.

```
         8)64320 rials.         1/12, 1/20|4271.25 piast. at 34½d.
As 32 : 17 : : 8040                       | 213.5625     = 12d.
                 17                    1/8| 355.9375     = 20d.
       32)136680                             44.4921     =  2½d.
          4271.25 Pias. plate.              613.992   + £613„19„10
```

EXERCISES.

1. Reduce 5420 Piastres 6 rials into Sterling; exchange 37½ ℘ dollar.
2. How much Spanish money in £675„2„11 Sterling; exchange 35d. ℘ piastre?
3. Reduce 8072 Piastres 2 rials 11 mar. vellon into Sterling; exchange 38¾d. ℘ dollar of exchange.
4. Find how much Sterling in 8653 Dollars 5 rials 16 mar. of old plate; exchange at 38⅝d.

V. With Lisbon.

In Portugal, Accounts are generally kept in Milrees and Rees, and they are distinguished by a mark set between them.

400 Rees = 1 crusado
1000 Rees = 1 Milree.
4800 Rees = 1 moidore.
6400 Rees = 1 joannes.

Exchange with London at a variable number of pence for 1 milree. *Par 67½ ster. ℘ Milree.*

Note. As Rees are thousandth parts of a Milree, the computations are best performed by decimals.

EXAMPLE.

Reduce 1360 Milrees 125 Rees into Sterling; exchange 64d. ℘ milree.

```
1/15, 1/4|1360.125
           340.03125
            22.66875
           362.7  =  £362„14.
```

EXERCISES.

1. Reduce 4786 Milrees 450 rees into Sterling; exchange at par.
2. How much money of Portugal in £1565„18„4 Sterling; exchange at 67½d. ℘ milree?
3. Reduce 7580 Crusados 310 rees into Sterling, at 65d. ℘ milree.

---

difference is sometimes made between the *effective* money and the Government paper. There is also a difference between the monies used for exterior and interior commerce; the latter money even varies in different provinces of Spain.

4. A Person brings 1800 Moidores from Portugal to Britain, where they are current for 27/. How much will he gain or lose, exchange 64d. ℘ milree?

Note. NAPLES and SICILY exchange by the Ducat of 100 Grani, and the computations are similar to those of Lisbon or France, in which the decimal system is used.

VI. WITH LEGHORN.

Leghorn keeps Accounts in Piastres or *Pezze*, soldi, and denari; and exchanges with London are likewise computed by these denominations.

12 denari = 1 soldi.
20 soldi = 1 Piastre, or Dollar.

Note. LEGHORN computes its Exchanges in money like that of *Livres, sous,* and *deniers* of France, to which we refer. GENOA also, and several other Italian Cities, compute in a similar manner.

VENICE gives, for the pound sterling, a variable number of Italian *livres* and *centimes,* similar to *francs,* and computes in the same manner.

Exchange with London at a variable number of pence ℘ Dollar.
Par 49d. ster. ℘ Piastre.

EXERCISES.

1. Reduce 1580 Piastres 15 soldi into Sterling; exchange at par.
2. How many Dollars or piastres of Leghorn in £325„18„4; exchange 50.
3. How many Guilders of Holland in 4860 Piastres; exchange 94d. Flem. ℘ piastre?
4. How many Marks of Hamburgh in 2490 Piastres; exchange 85¾d. Flem. ℘ piastre?

VII. SUNDRY PLACES.

The following Places, though not contained in *Lloyd's List,* occasionally exchange with London.

PETERSBURGH gives the rouble for 11d. *sterling,* more or less.

GOTTENBURGH ...	gives	4½	rix-dollars of 48/. ...	*℘ pound sterling more or less.*
COPENHAGEN	......	6	rix-dollars of 96/. ...	
DANTZIC............	......	25	florins of 30 groschen	
KONIGSBURGH	......	19	florins of 30 groschen	
CONSTANTINOPLE and SMYRNA	.....	18	piastres of 80 aspers	

Exchange operations between London and other Trading Cities on the Continent are mostly effected by Bills on Amsterdam, Hamburgh, or some other of the foregoing Places.

VIII. WITH DUBLIN.

Accounts in Ireland are kept in Pounds, shillings, and pence, as *in England.* The par of an English shilling is one shilling and one penny Irish, and therefore £100 English is equal to £108„6„8 Irish, but the course of Exchange varies from 6 to 20 ⅌ Cent. *Par* 8⅓.

A Shilling sterling, = 13d. Irish.
A Pound .... = 21/8d.
A Guinea .... = 22/9d.

Note. To reduce British Sterling into Irish at par, add $\frac{1}{12}$; and to reduce Irish at par into British, deduct $\frac{1}{13}$ from the Irish.

EXERCISES.

1. In £750„12„6 British Sterling, how much Irish money; exchange at par, or at 8⅓ ⅌ Cent.?

2. How much British Sterling in £1626„7„1 Irish; exchange at par?

3. How much Irish Money is equal to £875„13 British; exchange at 12½ ⅌ Cent.?

4. What is the value in Sterling of a Prize of £5000 in the Irish Lottery; exchange at *par*?

IX. WITH LONDON.

Several Places in Great Britain exchange with London at a small premium in favour of London; and the premium is generally computed for time, that is, by drawing the Bills on London at a certain number of days after date.

According to this practice, 73 days, (being one-fifth of a year,) are equal to 1 ⅌ Cent.

EXERCISES.

1. Leeds draws on London for £350„10, premium ⅝ ⅌ Cent.; how much did the Bill cost?

2. Purchased a Bill on London drawn at 50 days after date; required how much ⅌ Cent. this is equivalent to?

3. A. in Newcastle receives for his friend in London £1000, which he means to remit to him by a Bank draft, whether is it more advantageous to take a Bill at 45 days, or pay a premium of ⅞ ⅌ Cent.?

X. WITH AMERICA.

Accounts are kept in Dollars and Cents, and America exchanges with London at par, or at so much ⅌ *Cent.*, either above or below par.

100 Cents. ...... = 1 dollar. Par 4/6 sterling.
40 Dollars...... = 9 pounds sterling.

EXERCISES.

1. Find the value in Dollars, of a Bill for £480 sterling, negotiated at a discount of 2½ ⅌ Cent.?

2. What sum in Sterling should a bill be drawn for to remit 3533 dollars, 33 cents, at the exchange of 6 ⅌ Cent. premium?

3. A Bill of £375 Sterling, drawn in London, was negotiated at a premium of 5 ⅌ Cent.; how many Dollars did it bring?

Currencies of the United States,

With Rules for reducing them into Sterling.

In Georgia and South Carolina, a Dollar being worth 4/6 currency, is at par, therefore,

£100 currency = £100 sterling.

In New England and Virginia, the Dollar is worth 6/. currency, therefore,

£133‚6‚8 currency = £100 sterling.

To reduce this Currency into Sterling deduct ¼.

In Delaware, Maryland, New-Jersey, and Pennsylvania, a Dollar is worth 7/6 currency; therefore,

£166‚13‚4 currency = £100 sterling.

To reduce this Currency into Sterling, multiply by 3, *and divide by* 5: *Or, take* ½ *and add* ⅕ *of that half.*

In New York and North Carolina, a Dollar is worth 8/. currency, therefore,

£179$\frac{7}{9}$ currency = £100 sterling.

To reduce this Currency into Sterling, multiply by 9, *and divide by* 16: *Or, take* ½ *and add* ⅛ *of that half.*

EXERCISES.

1. How much Sterling in £1475‚10, Virginia currency; exchange 133⅓?
2. In £840‚14‚7 Currency of Maryland, how much Sterling; exchange 166⅔?
3. Reduce £1083‚16 New York Currency into Sterling; exchange 177$\frac{7}{9}$?

XI. With the West Indies.

Accounts are kept in Pounds, shillings, and pence *Currency.*

£140 currency = £100 sterling.

A hard or Spanish dollar is valued at 6/8 currency.

Bills and dollars generally bear a premium.

EXERCISES.

1. In £840‚14‚7 Jamaica Currency, how much Sterling; exchange 140?
2. Find the value in Currency of a Bill £573‚12‚6 Sterling, sold at a premium of 10 ℘ Cent.?
3. What is the value in Sterling of 4800 Dollars, purchased at a premium of 3¾ ℘ Cent.?

SIMPLE ARBITRATION.

Simple Arbitration finds the proportion between the exchanges *of any two* Places with respect to a third.

Questions are stated as in Simple Proportion, the *first* and *third* terms being always the same, and the second term the same as the required *par*.

Of Drawing and Remitting.

Rule. *Draw upon the Place where the course of Exchange is below the arbitrated price, and remit to the Place where the course is above the arbitrated price.*

EXAMPLES.

1. Suppose the Course of exchange from London to Madrid be 34d. ℘ Piastre, and from London to Lisbon 68d. ℘ Milree. Required the arbitrated price between Madrid and Lisbon; that is, how many Rees should be given for 1 piastre?

rees
If 68d. : 1000 : : 34d. : 500 rees. Answer.

2. If the exchange from London to Lisbon be 68d. ℘ Milree, and from London to Madrid 34d. ℘ Piastre; and Madrid advises London that the exchange for Lisbon is 528 Rees ℘ Piastre. How ought London to draw and remit with advantage, and what is the profit on a bill of £100?

The arbitrated price between London and Madrid was found to be 500 Rees, and the advised course is 525 Rees; then, as the course of exchange between Lisbon and Madrid is, with respect to Lisbon, below the arbitrated price, for 352 Milrees 941 rees, at 68d. ℘ milree, London must draw upon Lisbon .... = £100. 0.0

And remit the value to Madrid at 525 Rees ℘ piastre is 672 pias. 2 r. 5 mar. at 34d. ℘ piastre............ = 95. 4.9

Gain to London £ 4.15.3

Or the gain may be found thus:

If 525 : 500 : : 100 : 95 : 4 : 9 remittance.
100 : 0 : 0
Ansr. £ 4 : 15 : 3 same as before.

Remarks. — It appears from these Examples, that when the advised and arbitrated course of exchange are not alike, or at par, that there is always a profit to be made by drawing and remitting with judgment.

2d. In Negotiations of this kind, the money you receive for your draft furnishes you with money to pay your remittance, and therefore your debt in one place is paid by your credit at the other. Hence an extensive credit, and a thorough knowledge in the arbitration of exchanges, makes a sufficient capital to carry on this beneficial business.

3. Suppose all things as before, but that Madrid advises London that the exchange for Lisbon is 480 rees ⅌ piastre; in what manner ought the negotiation to be made?

London must draw on Madrid for 705 piastres 7 rials 2 mar. at 34d. ⅌ piastre............................= £100,0,0

And remit to Lisbon 338 milrees 823 rees, at 480 rees ⅌ piastre, at 68d. ⅌ milree..........................= 96,0,0

Gain to London £ 4,0,0

Or if 500 : 480 : : 100 : £96 : 0 : 0 remittance.
4 : 0 : 0 gain.
£ 100 : 0 : 0 draft.

EXERCISES.

1. If the exchange from London to Amsterdam be 36/3 Flemish ⅌ £ sterling, and from Amsterdam to Hamburgh 34 stivers ⅌ dollar; what is the rate of exchange between London and Hamburgh by arbitration?
2. When the exchange from London to Hamburgh is 35/., and to Amsterdam 33 stivers; required the arbitrated course between London and Amsterdam.
3. If the course of exchange in Hamburgh on London, at 2 usance, be 33/4 Flemish ⅌ £ sterling; what should it be at sight, reckoning 1 ⅌ Cent. for the time?
4. If the exchange between London and Paris be 23 livres 15 sous ⅌ £ sterling, and between London and Amsterdam 10 florins, 15 stivers; how many Flemish pence are equal to 3 francs?
5. If the exchange from London to Hamburgh be 34/2 Flemish ⅌ £ sterling, and from London to Paris 23 livres, 10 sous; how many francs are equal to 100 marks?
6. If Paris exchange with Madrid at 14 Francs 50 Centimes for 1 Pistole, and with London at 23 Francs 95 Centimes ⅌ £ Sterling; what is the arbitrated price between Madrid and London?
7. Required the arbitrated course of exchange between Spain and Portugal, when the exchange between Spain and Britain is 37½d. ⅌ piastre, and between Britain and Portugal 64d. ⅌ milree.

3d. In all negotiations of Bills of Exchange there are two parties principally concerned; namely, sellers of Bills called Drawers, and Buyers of bills called Remitters, and their interests are opposite with respect to the price or course of exchange. In direct exchange, that is, when Bills are negotiated between two Places only, the interest or advantage of the Drawer is the same as the interest of the Place on which he draws, and the reverse takes place with regard to the Remitter. Thus, for example, when the exchange is in favour of London, it is in favour of the London Remitter, and against the London Drawer.

8. Amsterdam exchanges with London at 35/5 Flemish ℘ £ sterling, and with Lisbon at 50d. Flemish ℘ crusado; how ought the exchange to go between London and Lisbon, to be on a par with the other two?

COMPOUND ARBITRATION.

Compound Arbitration discovers the most advantageous mode of negotiating Bills, in cases where more than three Places are concerned.

The questions here may be solved by several statings in Simple Arbitration, but more easily by the following.

Rule 1. *Distinguish the given Courses of exchange into Antecedents and Consequents, and place them in columns fronting each other.*

2. *The first Antecedent, and last Consequent to which an antecedent is required, must be of the same kind.*

3. *The first Consequent must be of the same name with the second Antecedent, and the second Consequent as the third Antecedent, and so on.*

4. *Multiply the Antecedents together for a divisor, and the Consequents for a dividend; and the quotient will be the answer or Antecedent required.*

Note. To shorten the operation such *antecedents* and *consequents* as are alike may be cancelled, and such as admit of being abridged may be reduced.

EXAMPLES.

1. If the exchange between London and Amsterdam be 10 Florins 16 stiv. ℘ £ sterling; between Amsterdam and Franckfort, 6/. Flemish for 65 creutzers; and between Franckfort and Paris, 52 creutzers for 3 francs: required the arbitrated exchange between London and Paris?

Antecedents. *Consequents.*
1 Pound ster. = 36/ Flem. (10 Fl. 16 stiv.)
6 sh. Flem. = 65 creutzers.
52 creutzers. = 3 francs.

$$\text{Then.}\ \frac{36/.\times 65\times 3}{6\times 52}=\frac{7020}{312}=22\ \text{Francs}\ 50\ \text{centimes.}$$

Remarks. — In order to carry on this business with profit, the difference between the given and arbitrated Courses of Exchange must, at least, be sufficient to pay the commission charged by the Agents for negotiating the Bills. The usual allowance is $\frac{1}{2}$ ℘ Cent. and is obtained by deducting from such consequent $\frac{1}{200}$ part.

2d. Instead of dividing each consequent as above, for brokerage, commission, &c. which prevents the terms from being properly

2. A. of London has 1500 Piastres at Leghorn, which may be drawn at 51d.; but to try what a circulation of the money will produce, orders them to be remitted first to Venice, at 94 piastres ⅌ 100 ducats; from thence to Paris, at 60 ducats ⅌ 300 francs; thence to Amsterdam, at 56d. Flem. ⅌ 3 francs; and lastly draws on Amsterdam, at 35/10 Flem. ⅌ £ sterling. Required the arbitrated price of the piastre between London and Leghorn, and whether the circular remittance be better than the direct draft, allowing ½ ⅌ Cent. commission at each Place?

$$\left.\begin{array}{rcl} \text{94 piastres} & = & 99\tfrac{1}{2}\text{ ducats} \\ \text{60 ducats} & = & 298\tfrac{1}{2}\text{ francs} \\ \text{3 francs} & = & 55\tfrac{18}{25}\text{d. Flem.} \\ \text{430d. Flem.} & = & \text{240d. ster.} \end{array}\right\}\text{commission deducted.}$$

How many pence ster. = 1 piastre?

$$\frac{99\frac{1}{2}\times 298\frac{1}{2}\times 55\frac{18}{25}\times 240}{94\times 60\times 3\times 430}=54\tfrac{59}{100}\text{ arbitrated price of the piastre, } \textit{nearly}.$$

Then, 1500 piastres @ the arbitrated price is £341„ 3„ 9*
.... @ the direct course, 51d. is 318„ 15„ 0
Gain by the circular exchange ...... £ 22„ 8„ 9

Another Method.

			Abridged.		
94 piastres	=	100 ducats.	47	=	50
60 ducats	=	300 francs.	1	=	5
3 francs	=	56d. Flem.	1	=	56
430d. Flem.	=	1 pound ster.	43	=	1
How many pounds ster. = 1500 piast.?				=	50

$$\frac{50\times 5\times 56\times 50}{47\times 43}=\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ \text{£}346„\ 7„\ 3$$

Deduct 1½ ⅌ Cent. com. for the three places ... 5„ 3„ 10
£341„ 3„ 5*

EXERCISES.

1. Money may be remitted from London to Amsterdam at 35/8 Flem. ⅌ £ sterling; and from Amsterdam to Paris, at 52 groots for 3 francs; and from Paris to Madrid, at 14 francs ⅌ pistole: required the rate of the piastre by arbitration?

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abridged, and of course renders the operation troublesome, by a tedious multiplication and division, we may allow as many commissions on the original *Sum* as there are Agents employed in the circulation of the money. This will give an answer with more ease, which differs very little from the true one, and which is sufficiently correct to show whether a *direct* or a *circular* exchange is most advantageous. *Vide* the second method above.

2. London has 9610 Livres at Venice, which may be drawn directly; exchange 50 livres ℘ £ sterling: or the value may be drawn on Amsterdam; exchange 36/3 Flem.: from Amsterdam to Lisbon, at 50d. Flem. ℘ crusado; from Lisbon to Madrid, at 630 rees ℘ piastre; and from Madrid to Venice, at 198 maravedis ℘ ducat. Required the cheapest way, and the difference.

3. Amsterdam has to remit to London £560 Flemish, the direct exchange being 11 florins 1 stiver ℘ £ sterling, but a Circular exchange may be made as follows: Amsterdam on Paris at 56d. Flem. for 3 francs; Paris on Venice 300 francs for 60 ducats; Venice on Hamburgh, 1 ducat for 100d. Flem.; Hamburgh on Lisbon 50d. Flem. ℘ crusado; and Lisbon on London at 64d. sterling ℘ milree. Required whether the direct or circular exchange is most advantageous.

4. Hamburgh has to remit to London £1318„10 Flemish, exchange at 35/6 Flem. ℘ £ sterling, but Bills on other Places can be had on the following terms: Hamburgh on Paris, 54d. for 3 francs; Paris on Venice, 300 francs for 56 ducats; Venice on Amsterdam, 1 ducat for 100d. Flemish; Amsterdam on Lisbon, 45d. Flem. for 1 crusado; and Lisbon on London 1 milree for 63d. sterling. Required whether the direct or circular exchange is most profitable, allowing ½ ℘ Cent. on each negotiation.

COMPOUND INTEREST.

Interest is of two kinds, Simple and Compound. Simple Interest is computed only on the Sum lent, although it should remain unpaid for several years: Compound Interest, by accumulating the interest with the Principal at the term when it is payable, and charging interest on the amount, during the following period.

Thus, if £100 be lent at 5 ℘ Cent., the amount, including interest, at the end of the year, is £105, which bears interest during the following year; and consequently the amount, at the end of two years, is £110„5: in like manner, the amount in three years will be £115„15„3.

Case I. To find the Amount, and also the Interest, of any Sum improved at Compound Interest.

Take the amount of £1 for the given rate and time from Table I., *and multiply it by the given sum. For the interest, deduct from the product the principal or sum lent.*

Ex. Find the amount and interest of £300, improved at 5 ℘ Cent. ℘ ann. for 9 years.

Amount of £1 for 9 years, is £1.551328

Mult. by 300

Ansr. The Amount is .... 465.3984=465„ 7„11½

Deduct principal .... 300„ 0„ 0

Ansr. The Interest is .... £165„ 7„11½

Note. To find the amount or present value of any sum, for a greater number than the Tables extend to; take two or more numbers from the Tables, whose *sum* will be equal to the number of years given in the question. The product of these numbers will be the amount or present value of £1 for the time required.

EXERCISES.

1. What is the amount of £500 for 30 years @ 4 ℘ Cent. compound interest?

2. How much will £1 amount to in 70 years, @ 5 ℘ Cent., improved at compound interest?

3. How much interest is due on £600 lent for 14 years, charging 5 ℘ Cent. on principal and interest at the end of each year?

4. A Bond of £3500, including compound interest for 9 years and 146 days, at 5 ℘ Cent., is to be taken up: how much money will it require?

Case II. To find the present Value of any Sum, or to find the Principal which will increase to a given Amount in any Number of Years.

Divide the given sum by the amount of £1 for the given rate and time taken from Table I.

Ex. What sum, lent at 5 ℘ Cent. compound interest for 9 years, will amount to £465„7„11½?

Remarks.—Simple Interest has been already treated of, and the most useful computations explained in several Cases. *Vide* page 117, &c.

2d. It is not lawful to charge compound interest directly; but the Lender may raise his interest when due, and lend it out again; and so, in effect, have compound interest. The computations are therefore necessary for ascertaining the improvement of money, and the value of Annuities.

3d. One *Penny* put out at 5 ℘ Cent. *Simple interest,* since the commencement of the Christian æra, would, at the end of the year 1830, only amount to 7/7½; whereas, at Compound interest, it would have increased to a greater Sum than could be contained in *five hundred millions of earths,* of solid gold, each of them as large as the globe of the earth.

4th. The computations in Compound Interest, and Annuities, are very tedious, and therefore Tables are always used in business. We *shall subjoin* the most usual ones, and show their use, in solving the *several Cases in this* rule.

Amount of £1 is 1.55132)465.397(£300 *Answ.*
465.396
1

EXERCISES.

1. What is the present value of £462‚16‚10, due at the end of 7 years, @ 5 ⅌ Cent. Compound Interest?
2. What sum at present is equivalent to receiving £1558‚6‚5, due at the end of 17 years, reckoning compound interest at 4 ⅌ Cent.?
3. What sum lent for 20 years at 5 ⅌ Cent. ⅌ Annum on the interest, as well as the principal, will amount to 1000 guineas?
4. A bond for £14,000 due in 9 years, is allowed to be taken up upon discount, @ 8 ⅌ Cent. ⅌ Annum; how much *Cash* just now will discharge the bond upon these conditions?

CASE III. TO FIND THE RATE OF INTEREST AT WHICH a SUM WILL INCREASE TO ANY PROPOSED AMOUNT.

Divide the amount by the principal, and the quotient will be found in TABLE I. *opposite to the given time, and under the rate ⅌ Cent. required.*

EXAMPLE.

At what rate of compound interest will £300 in 9 years amount to £465‚7‚11½?

300) 465.397
1.55132 found under 5 ⅌ Cent. *Answer.*

EXERCISES.

1. If £150 be lent at 5 ⅌ Cent. ⅌ Annum for 9 years, and amount to £232‚14. Required the rate ⅌ Cent.
2. At what rate of compound interest will £400 amount to £3594, in 45 years?
3. £1040 was lent for 15 years, and by accumulating the interest with the principal, it amounted to £1800. Required at what rate of interest the money was laid out?

CASE IV. TO FIND IN WHAT TIME A GIVEN SUM WILL INCREASE TO ANY PROPOSED AMOUNT, WHEN IMPROVED AT COMPOUND INTEREST.

Divide the amount by the principal as before, and look for the quotient in TABLE I. *under the given rate, opposite to which is the number of years.*

EXAMPLE.

In what time will £300 amount to £465„7„11½ à 5 ⅌ Cent. compound interest?

300) 465.397
1.55132 found opposite 9 years. *Answer.*

Note. When the (quotient) number does not correspond to the Table, the number of *days* to the *years* may be found by the following proportion:

As the difference between the next lower, and next higher number in the Table : is the difference between the number looked for, and the next lower one : : so is 365 days in a year : to the days to be added.

Ex. 2. How long will £100 require to be lent at 5 ⅌ Cent. compound interest, till it amount to £350?

100 | 350
26 years = 3.5556 | 3.50 found between 25 and 26 years.
3.3863 | 3.38635 days.
.1693 : .11365 : : 365 : 245 days.

The *Answer* is 25 years 245 days.

EXERCISES.

1. If £400 be lent at 5 ⅌ Cent. compound interest, till the amount was £562„16„10: How long was the money lent?
2. In what time will any sum be doubled at 4, 5, and 6 ⅌ Cent., accumulating the interest with the principal, as it becomes due at the end of each year?
3. How long will £50 improved at 8 ⅌ Cent. compound interest be in amounting to £185?

QUERIES.

1. What is the meaning of Compound Interest?
2. Can a Person legally lend his money so as to have compound interest for it?
3. How do you find the *Amount* or *Interest* of any sum improved at compound interest?
4. How do you find the *Principal*, or *present* value of any sum which will increase to any given amount?
5. How do you find the *Rate* of compound interest, at which a sum will increase to any proposed amount?
6. How do you find the *Time* in which a sum will increase to any given amount?

ANNUITIES.

An Annuity is a Sum of money paid annually to any person for a term of years, for life, or for ever.

If the payment of an Annuity be delayed for several years, we may compute on this principle how much the whole will Amount to, allowing compound interest on each year's annuity from the time it became due; for an annual pension, salary, or annuity, may be considered as arising from an imaginary principal, and admits of such improvement.

Note. The *amount* of an annuity at compound interest for any number of years; the *annuity* which will amount to a given sum, and the *rate* and *time*, may be found in the same manner as in last section by Table II.

Also, the *present value*, or sum of money that will purchase an annuity, by Table III.

EXERCISES.

1. What is the amount of an Annuity of £80 in 10 years, at 5 ℘ Cent. compound interest?

2. What yearly Salary or pension will amount to £1200 in 14 years, at 4 ℘ Cent. compound interest?

3. An Annuity of £80 remained unpaid for 20 years, and amounts, with interest, to £2645„5„6; what ℘ Cent. was charged on the annuity as it became due?

4. In what time will an annual Pension of £60 amount to £800, interest at 4 ℘ Cent.?

¶ 5. A Gentleman purchases an Estate of £1200 a-year, and draws 8 ℘ Cent. by discounting bills with the rents: required the amount in 20 years.

6. A Person has £1500, which he proposes to lay out on an annuity to continue 25 years: how much will it purchase at 4 ℘ Cent. interest?

7. A. owes B. £1000 due at present, which he agrees to pay by an annuity to continue 7 years: what equivalent sum ℘ annum ought A. to pay, at 5 ℘ Cent. interest?

8. A Person owes £1000, and wishes to appropriate £20 a-year to liquidate it. In what time will the debt be discharged, reckoning interest at 4 ℘ Cent.?

9. A. wishes to have a lease of Lands renting £150 annually, of which 14 years are to run: how much cash should he pay, allowing 5 ℘ Cent. discount?

10. If a Person possessed of £1000 improve his money at 5 ℘ Cent. ℘ annum, and live at the rate of £100 a-year: how long will it be before all be spent?

11. A Farmer, on obtaining a lease of ground for 19 years, pays a fine or grassum of £500: how much additional rent would have been equal to the same, interest 5 ℘ Cent.?

12. A Gentleman wants to sink £2000 for an annuity to continue 20 years: what yearly sum is equivalent, allowing compound interest at 5 ℘ Cent. to both parties?

TABLE I. The Amount of £1. when improved at Compound Interest.

Yrs.	4 ℘ Cent.	5 ℘ Cent.	6 ℘ Cent.	7 ℘ Cent.
1	1.040000	1.050000	1.060000	1.07000
2	1.081600	1.102500	1.123600	1.14490
3	1.124864	1.157625	1.191016	1.22504
4	1.169858	1.215506	1.262476	1.31079
5	1.216652	1.276281	1.338225	1.40255
6	1.265319	1.340095	1.418519	1.50073
7	1.315931	1.407100	1.503630	1.60578
8	1.368569	1.477455	1.593848	1.71818
9	1.423311	1.551328	1.689478	1.83845
10	1.480244	1.628894	1.790847	1.96715
11	1.539454	1.710339	1.898298	2.10485
12	1.601032	1.795856	2.012196	2.25219
13	1.665073	1.885649	2.132928	2.40984
14	1.731676	1.979931	2.260903	2.57853
15	1.800943	2.078928	2.396558	2.75903
16	1.872981	2.182874	2.540351	2.95216
17	1.947900	2.292018	2.692772	3.15881
18	2.025816	2.406619	2.854339	3.37293
19	2.106849	2.526950	3.025599	3.61652
20	2.191123	2.653297	3.207135	3.86968
21	2.278768	2.785962	3.399563	4.14056
22	2.369918	2.925260	3.603537	4.43040
23	2.464715	3.071523	3.819749	4.74052
24	2.563304	3.225099	4.048934	5.07236
25	2.665836	3.386354	4.291870	5.42743
26	2.772469	3.555672	4.549382	5.80735
27	2.883368	3.733456	4.822345	6.21386
28	2.998703	3.920129	5.111686	6.64883
29	3.118651	4.116135	5.418387	7.11425
30	3.243397	4.321942	5.743491	7.61225
31	3.373133	4.538039	6.088100	8.14511
32	3.508058	4.764941	6.453386	8.71527
33	3.648381	5.003188	6.840589	9.32533
34	3.794316	5.253347	7.251025	9.97811
35	3.946088	5.516015	7.686086	10.6765
36	4.103932	5.791816	8.147252	11.4239
37	4.268089	6.081406	8.636087	12.2236
38	4.438813	6.385477	9.154252	13.0792
39	4.616365	6.704751	9.703507	13.9948
40	4.801020	7.039988	10.285717	14.9744

TABLE II. The Amount of £1. *Annuity*, or £1. ℘ *Annum*, improved at Compound Interest.

Yrs.	4 ℘ Cent.	5 ℘ Cent.	6 ℘ Cent.	7 ℘ Cent.
1	1.000000	1.000000	1.000000	1.00000
2	2.040000	2.050000	2.060000	2.07000
3	3.121600	3.152500	3.183600	3.21490
4	4.246464	4.310125	4.374616	4.43994
5	5.416322	5.525631	5.637092	5.75073
6	6.632975	6.801912	6.975318	7.15329
7	7.898294	8.142008	8.393837	8.65402
8	9.214226	9.549108	9.897467	10.2598
9	10.582795	11.026564	11.491315	11.9779
10	12.006107	12.577892	13.180794	13.8164
11	13.486351	14.206787	14.791642	15.7836
12	15.025805	15.917126	16.869941	17.8884
13	16.626837	17.712982	18.882137	20.1406
14	18.291911	19.598631	21.015065	22.5504
15	20.023587	21.578563	23.275969	25.1290
16	21.824531	23.657491	25.672528	27.8880
17	23.697512	25.840366	28.212879	30.8402
18	25.645412	28.132384	30.905652	33.9990
19	27.671229	30.539003	33.759991	37.3789
20	29.778078	33.065954	36.785591	40.9954
21	31.969201	35.719251	39.992726	44.8651
22	34.247969	38.505214	43.392290	49.0057
23	36.617888	41.430475	46.995827	53.4361
24	39.082604	44.501998	50.815577	58.1766
25	41.645908	47.727098	54.864512	63.2490
26	44.311744	51.113453	59.156382	68.6764
27	47.084214	54.669126	63.705765	74.4838
28	49.967582	58.402582	68.528111	80.6976
29	52.966286	62.322711	73.639798	87.3465
30	56.084937	66.438847	79.058186	94.4607
31	59.328355	70.760789	84.801677	102.073
32	62.701468	75.298829	90.889778	110.218
33	66.209527	80.063770	97.343164	118.933
34	69.857908	85.066959	104.183754	128.258
35	73.652224	90.320307	111.434779	138.236
36	77.598313	95.836322	119.120866	148.913
37	81.702246	101.628138	127.268118	160.337
38	85.970336	107.708545	135.904205	172.561
39	90.409149	114.095023	145.058458	185.640
40	95.025515	120.799774	154.761965	199.635

TABLE III. Present Value of £1. *Annuity* at Compound Interest.

Yrs.	4 ⅌ Cent.	5 ⅌ Cent.	6 ⅌ Cent.	7 ⅌ Cent.
1	0.961539	0.952381	0.943396	0.9345
2	1.886095	1.859410	1.833393	1.8080
3	2.775091	2.723248	2.673012	2.6243
4	3.629895	3.545951	3.465106	3.3872
5	4.451822	4.329477	4.212364	4.1001
6	5.242137	5.075692	4.917324	4.7665
7	6.002055	5.786373	5.582382	5.3892
8	6.732745	6.463213	6.209794	5.9712
9	7.435331	7.107822	6.801692	6.5152
10	8.110896	7.721735	7.360087	7.0235
11	8.760476	8.306414	7.886875	7.4986
12	9.385073	8.863252	8.383844	7.9426
13	9.985647	9.393573	8.852683	8.3576
14	10.563122	9.898641	9.294984	8.7454
15	11.118387	10.379658	9.712249	9.1079
16	11.652295	10.837770	10.105895	9.4466
17	12.165668	11.274066	10.477260	9.7632
18	12.659296	11.689587	10.827604	10.059
19	13.133939	12.085311	11.158117	10.335
20	13.590325	12.462210	11.469921	10.594
21	14.029159	12.821153	11.764077	10.585
22	14.451114	13.163003	12.041582	11.061
23	14.856841	13.488574	12.303379	11.272
24	15.246962	13.798642	12.550358	11.469
25	15.622079	14.093945	12.783356	11.653
26	15.982768	14.375185	13.003166	11.825
27	16.329584	14.643034	13.210534	11.986
28	16.663062	14.898127	13.406164	12.137
29	16.983713	15.141074	13.590721	12.277
30	17.292032	15.372451	13.764831	12.409
31	17.588492	15.592810	13.929086	12.531
32	17.873550	15.802677	14.084044	12.646
33	18.147644	16.002549	14.230230	12.753
34	18.411196	16.192904	14.368141	12.854
35	18.664612	16.374194	14.498247	12.947
36	18.908280	16.546852	14.620987	13.035
37	19.142577	16.711287	14.736780	13.117
38	19.367863	16.867893	14.846019	13.193
39	19.584483	17.017041	14.949075	13.264
40	19.792772	17.159086	15.046297	13.331

FREEHOLDS.

In Freehold Estates or Perpetual Annuities there are three things to be considered: 1st, The price or value of the Freehold; 2d, The yearly rent or annuity; and 3d, The rate of interest; all of which are comprised in the following Cases.

CASE I. TO FIND THE VALUE OR PRICE WHICH OUGHT TO BE GIVEN FOR A FREEHOLD ESTATE.

RULE. *Multiply the annual rent by* 100, *and divide by the rate of interest. The quotient is the answer.*

*Or, As the rate of £*1 *is to £.; so is rent to the value required.*

EXAMPLE.

The yearly rent of a Freehold Estate is £500; how much money is it worth, allowing the Purchaser 5 ℘ Cent.?

By method 1. $$\frac{500 \times 100}{5} = \underline{\underline{\pounds 10{,}000}}\ \textit{Ans.}$$

or, $$.05 : 1 :: 500 : \underline{\underline{\pounds 10{,}000}}\ \textit{as before.}$$

EXERCISES.

1. What is the value of a Perpetual Annuity of £50, discounting at the rate of 5 ℘ Cent.?

2. What should I give for a Freehold Farm which is let for £210, so as to have 6¼ ℘ Cent. for my money?

3. The yearly rent of a Freehold Estate is £900; what is its value allowing money to be worth 4½ ℘ Cent.?

CASE II. TO FIND THE ANNUAL RENT WHICH A FREEHOLD ESTATE OUGHT TO PRODUCE, SO AS TO ALLOW THE PURCHASER A GIVEN RATE OF INTEREST FOR HIS MONEY.

RULE. *Multiply the purchase money by the proposed rate ℘ Cent. and divide by* 100: *the quotient is the annual rent.*

*Or, As £*1 *is to its rate of interest, so is the value to the rent or annuity.*

EXAMPLE.

A Gentleman purchased an Estate for £10,000, and had 5 ℘ Cent. for his money: how much is the yearly rent?

$$\frac{10{,}000 \times 5}{100} = \underline{\underline{\pounds 500}}\ \text{Ans.}$$

$$\text{Or, As } \pounds 1 : .05 :: \underline{\underline{\pounds 10{,}000}} : \pounds 500\ \textit{as before.}$$

EXERCISES.

1. A Person proposes to lay out £900 in the purchase of a perpetual annuity, so as to have 4½ ℘ Cent. for his money; how much should be the annuity?

2. A Freehold Farm is sold for £3750; what must be the yearly rent to allow the proprietor 6 ℔ Cent. for his money?

3. A. bought an estate for £7500, and a person offers to rent it, so as to allow him 7½ ℔ Cent. for his money; what should be the clear annual rent?

CASE III. TO FIND WHAT RATE OF INTEREST A PURCHASER DRAWS FROM A FREEHOLD ESTATE.

RULE. *Multiply the annual rent by* 100, *and divide by the sum paid for the purchase. The quotient gives the rate ℔ Cent.*

Or, As the value or purchase is to the rent, so is £100 *to the rate ℔ Cent.*

EXAMPLE.

A Freehold Estate which draws £500 of annual rent was purchased for £10,000; what rate ℔ Cent. has the proprietor for his money?

$$\frac{500 \times 100}{10000} = 5 \text{ ℔ Cent. } \textit{Ans.}$$

Or, As 10,000 : 500 : 100 : 5 ℔ Cent. *as before.*

EXERCISES.

1. A Person paid £625 for a perpetual annuity of £25; what rate of interest has he for his money?

2. A Freehold Estate of £500 a-year was sold for £8000; what rate ℔ Cent. has the purchaser for his money?

3. A. purchases from B. a property in the Country for £15,000, which is rented at £1125. How much ℔ Cent. will A. draw for his money yearly?

CASE IV. TO FIND HOW MANY YEARS' PURCHASE SHOULD BE GIVEN FOR A FREEHOLD ESTATE, TO ALLOW THE PURCHASER A CERTAIN RATE ℔ CENT. FOR HIS MONEY.

RULE. *Divide* 100 *by the proposed rate of interest to be obtained by the purchase.*

EXAMPLE.

A Gentleman would wish to purchase a Freehold Estate, and to have 5 ℔ Cent. for his money; how many years' purchase should he offer?

5|100

Ans. 20 years' purchase.

Note. The following Table (calculated by the preceding Rule) *shows the number* of years' purchase that ought to be given for a *Freehold Estate,* so as to allow the Purchaser the several rates *℔ Cent. for his* money.

	purchase.		purchase.
3 ℘ Cent. is equal to	$33\frac{1}{3}$ yrs.	6 ℘ Cent. is equal to	$16\frac{2}{3}$ yrs.
$3\frac{1}{3}$ ℘ Cent.	30 yrs.	$6\frac{2}{3}$ ℘ Cent.	15 yrs.
$3\frac{1}{2}$ ℘ Cent.	$28\frac{4}{7}$ yrs.	7 ℘ Cent.	$14\frac{2}{7}$ yrs.
4 ℘ Cent.	25 yrs.	$7\frac{1}{2}$ ℘ Cent.	$13\frac{1}{3}$ yrs.
$4\frac{1}{2}$ ℘ Cent.	$22\frac{2}{9}$ yrs.	8 ℘ Cent.	$12\frac{1}{2}$ yrs.
5 ℘ Cent.	20 yrs.	$8\frac{1}{3}$ ℘ Cent.	12 yrs.
$5\frac{1}{2}$ ℘ Cent.	$18\frac{2}{11}$ yrs.	9 ℘ Cent.	$11\frac{1}{9}$ yrs.

EXERCISES.

1. A Person will buy a Freehold Farm provided he has $6\frac{1}{4}$ ℘ Cent. for his money; how many years' purchase should he offer?

2. B. agrees to sell to A. a Freehold Property, and allow him $7\frac{1}{2}$ ℘ Cent. for his money: how many years' purchase ought A. to offer; and supposing it let at £187.10 a year, how much money will it bring?

CASE V. TO FIND WHAT RATE OF INTEREST ℘ CENT. A PERSON HAS FOR HIS MONEY, BY PURCHASING AT SO MANY YEARS OF ANNUAL RENT.

RULE. *Divide* 100 *by the number of years' purchase.*

EXAMPLE.

A Gentleman purchases an Estate at 20 years' purchase; what rate of interest has he for his money?

20|100

Ans. 5 ℘ Cent.

EXERCISES.

1. A Freehold Estate is sold at 16 years' purchase; what rate ℘ Cent. has the buyer for his money?

2. A bought a Freehold Estate at 24 years' purchase; how much interest has he for his money?

3. A Person straitened for money agrees to sell a Freehold Property at $11\frac{3}{7}$ years' purchase; how much interest ℘ Cent. is that equivalent to?

PROMISCUOUS EXERCISES.

1. A Freehold Farm was bought for £1350; at what rent must it be let to clear itself in 15 years?

2. A Person purchased a Freehold Property for £4500, which he let at £250 ℘ Annum; in what time will it bring in the purchase money?

3. If a Freehold Estate, which lets for £375, will clear itself in $13\frac{1}{3}$ years, what is its present value?

4. A wishes to lay out £10,000 in the purchase of a Freehold Estate, and to have 8 ⅌ Cent. for his money; in what time will the estate clear itself?

QUERIES.

1. How many things are to be considered in Freeholds?

2. How do you find the *value or price* which ought to be given for a Freehold Estate?

3. How do you find the *annual rent* which a Freehold Estate ought to produce, to afford a certain rate of interest to the purchaser?

4. How do you find what *rate* of interest a purchaser draws from a Freehold Estate?

5. How do you find how *many years'* purchase should be given for a Freehold, so as to allow the purchaser a certain rate of interest?

6. How do you find what rate of interest a person has by purchasing at so *many years'* annual rent?

REVERSIONARY ANNUITIES.

An Annuity is said to be in Reversion when the Purchaser, on paying the price, does not immediately enter upon possession, the annuity or reversion not commencing till some time after.

Case I. To find the Value of a Freehold Estate, or a Perpetual Annuity in Reversion.

Rule. *Find the value of the Estate as if possession were to commence presently; then (by* Table III.) *find the present value of the rent for the time prior to the commencement; subtract this value from the first, and the remainder is the value of the reversion.*

EXAMPLE.

The reversion of a Freehold Estate of £500 a year, to commence 5 years hence, is to be sold; how much money is it worth, computing at 4 ⅌ Cent. interest?

$$\frac{500 \times 100}{4} = £12500$$

Table III. 4.451822
500 £
2225.911

Value of the Estate, if entered on at present, £12500
Deduct the value of 5 years' possession 2225.911
Ans. Value of the Reversion £10274.1.9¼ = 10274.089

EXERCISES.

1. How much money at present should a Person pay to be equal to an Income of £280 yearly, to commence 8 years hence, and to continue 15 years, interest 5 ℘ Cent.?

2. A. has the possession of a Freehold Estate of £300 for 14 years; B. has the reversion of the same for ever, after A. Required the value of A.'s possession, and of B.'s reversionary interest as above?

3. What is the present value of 50 years' possession of an Estate of £300 a year, to begin at the expiration of 19 years, interest at 4 ℘ Cent.?

CASE II. TO FIND THE YEARLY RENT OR INCOME OF A FREEHOLD, TO ALLOW THE PURCHASER A CERTAIN RATE ℘ CENT. FOR HIS MONEY.

RULE. *Find the amount of the price of the reversion for the time prior to the commencement* (*by* TABLE I.); *then find the annuity which that sum will purchase.*

EXAMPLE.

A Freehold Estate, to commence 19 years hence, is bought for £5000: required the yearly rent, allowing the purchaser 5 ℘ Cent. for his money?

Amount of £1 for 19 years is £2.52695
5000£
Amount £ 12634.75
(By CASE II. of last section) mult. by .05
Ans..........£631„14„9 = 631.7375

EXERCISES.

1. A Freehold Estate was sold for £6000, *Cash* down; but possession is not to take place till 14 years hence: now, allowing the purchaser 5 ℘ Cent. interest for his money, what is the yearly rent?

2. The reversion of a Freehold Farm, upon which there is an annuitant for 17 years, is purchased for £1000, compound interest being allowed at 4 ℘ Cent. Required the yearly rent?

QUERIES.

1. What are Reversionary Annuities?
2. How do you find the value of a Freehold Estate in reversion?
3. How do you find the yearly rent or income of a Freehold, to allow the purchaser a certain rate ℘ Cent.?

MISCELLANEOUS QUESTIONS.

1. A Woollen-draper sells 25 yards of fine black cloth at 19/. ⅌ yard, 14 yards of blue at 18/4, and 15 yards of mixture at 12/8; he allows the purchaser 5 ⅌ Cent. discount for cash, how much money will he receive from the purchaser?

2. A Shopkeeper sold 15 pieces of linen, each 52 yards at 2/8 ⅌ yard, 6 pieces of printed calicoes, each 28 yards at 2/3, and 4 pieces of gingham, each 30 yards at 1/10½. The purchaser is willing to allow 7½ ⅌ Cent. advance, in order to have long credit: how much money will discharge the account when the credit is expired?

3. A Grocer mixes together 3 Cwt. 2 qrs. sugar at 80/. ⅌ Cwt.; 2 Cwt. 1 qr. at 75/.; and 1 Cwt. 3 qrs. at 7½d. ⅌ lb. Required the value of an Cwt. of the mixture, and at what rate ⅌ lb. must it be sold, so that the owner may gain 2d. on the shilling?

4. A Baker has on hand 120 sacks of flour of second quality at 50/. ⅌ sack; and he wishes to mix it with as much of fine flour at 70/. ⅌ sack as will afford him a profit of 20 ⅌ Cent. when he sells the mixture at 66/. Required how many sacks of the fine flour he must mix?

5. A Bookseller orders from London, 20 Reams demy writing paper at 57/6 ⅌ ream; freight and other charges £1„14. He sells the paper at 4/. ⅌ quire, excepting the outside quires of each ream, which being damaged, and short in the number of sheets, he charges at half price. Required his gain or loss, and how much ⅌ Shilling, and ⅌ Cent.?

6. Required the prime cost of a Ream of foolscap paper, weighing 15 lbs., made from rags at £35 ⅌ ton; wastage in the manufacturing, 25 ⅌ Cent.; expense 7/6 ⅌ ream, besides a duty of 3d. ⅌ lb. on the paper?

7. A Paper-maker has a stock of £3000 to carry on his business. He employs 30 hands, whose wages one with another is 11/. ⅌ week. The annual repairs and other expenses at the work amount to £250. There are consumed yearly 12 tons of rags at £40 ⅌ ton; 16 tons at £30; and 20 tons at £20; from which there are made 1200 reams demy printing paper, price 23/. ⅌ ream; 1700 reams at 18/., and 2380 reams crown paper at 13/. The duty is estimated at 22½ ⅌ Cent. on the price. Required his gain or loss, allowing 5 ⅌ Cent. interest on his stock?

8. The wastage in making Paper from rags at £45 ⅌ ton, is *one-tenth;* the weight of the paper from it 20 lb. ⅌ ream, and the price 25/. ⅌ ream, expenses 7/6; the wastage from rags at £30 is *one-seventh;* the weight of the paper 18 lbs. ⅌ ream, price 20/., and expenses 6/. ⅌ ream; and the wastage from rags at £28, *one-fifth;* the weight of the paper 15 lb. ⅌ ream, price 15/., expenses 5/. The duty on each kind of paper is 3d. ⅌ lb. Required which yields most profit ⅌ ton?

9. A Stationer buys 5000 Quills, unsorted, at 12/6 ⅌ thousand; when separated he had 3000 of a good sort, and 1500 inferior ones;

the remainder was of no value. The expense of assorting them was 7/6. He intends to sell his inferior quills at half the price of the best. Required how much he must charge a 100 of each kind, to have a profit of 3d. on the shilling?

10. A Builder finished a House which cost him £3514.10; it consists of four stories besides the ground floor, which is divided into 2 shops, one of which is let at £50, and the other for 40 guineas. The first story is let at £65; the second at £50; the third at £40; and the fourth at £35. The annual expenses for repairs are estimated at 10 guineas. Required how much ℘ Cent. he has yearly for his money?

11. A Chapel is built to contain 2000 persons, the expense of which is as follows: Ground 75 feet by 70, at a guinea ℘ square yard; the mason's bill, £783.15; slater's, £128.16.6; carpenter's, £1210.7.5; plumber's, £83.16.3; plasterer's, £89.17.8; ironmonger's, £52.14.11; lustres and other charges, £68.2.3. There are 120 of the Seats let at 15/.; 180 at 13/4; 420 at 10/.; 480 at 8/.; 510 at 6/8; and the rest at 5/. The minister's stipend, which is £400, is paid from the seat rents. Required how much ℘ Cent. the Proprietors will receive for their money?

12. A Dealer in Teas has on hand 4 chests of Congou, weighing net each 3 qrs. 16 lbs., for which he paid 3/9 ℘ lb. besides a duty of 40 ℘ Cent. a year ago. Required how he must rate it ℘ lb. to B. that by taking his bill at 3 months, and discounting it at his Banker's, he may clear 20 ℘ Cent. by the sales?

13. A Dealer in Wines has a pipe of Port, which contains at present 56 dozen, and may be sold at 33/. ℘ dozen. If he keep it on hand 18 months, he expects to sell it at 38/.; but besides losing the use of the money, which he reckons worth 7½ ℘ Cent. ℘ annum, the leakage will be 1 dozen 9 bottles, and expense of cellar rent and other charges 25/. Required his gain or loss by keeping it?

14. A Linen Merchant buys 680 lbs. dressed flax at 2/9, and delivers it to be spun into yarn at 1¼ spindles ℘ lb.; every spindle makes 3¼ yards linen. The expense of spinning 16½d. ℘ spindle; weaving 5¾d.; and bleaching 3d. ℘ yard. He sells one-fourth of the linen at 2/3; one-fourth at 2/2; and the remainder at 2/. ℘ yard. Required his gain or loss?

15. An Ironmonger imports from Sweden 50 tons of Iron at £24.10 ℘ ton; charges at shipping 1½ ℘ Cent.; he pays at landing, duty 7 ℘ Cent; freight 45/ ℘ ton; and cartage 1/1 ℘ do.; insurance 3 guineas on the covered property; policy 5/6 ℘ Cent. Required the prime cost ℘ Cwt.?

16. A Plumber contracts with the Magistrates of a Town, to bring water in lead pipes. The fountain is 2 miles 1 furlong 5 yds. distant; and the pipe weighs 22 lbs. ℘ yard, which, including the expense of laying it, is 5d. ℘ lb. The Reservoir is 18 feet long, 12 wide, and 9 deep, which is lined with lead, at 9 lbs. to each 1 square foot, at 4½d. ℘ lb.; the expense of digging and filling up the trench for the pipe, is 1/3 ℘ yard; other charges £21.18.1. Required the whole expense; and as 200 of the inhabitants have

agreed to pay as much yearly as will amount to 5 ⅌ Cent. on the money expended, how much must each pay?

17. A Manufacturer of linen purchases 360 spindles of lint Yarn, which he weaves in 1600¾ reed. Required how much linen it will make, allowing the weft to require ⅛th part less than the warp, and that the cloth loses $\frac{1}{20}$th part in the manufacturing?

N. B. There are two threads in the warp for each split in the reed.

18. A Maltster purchases 1200 quarters Barley, at 46/. ⅌ quarter, and converts it into malt; each quarter produces 9 bushels of malt. He pays duty 3/6 ⅌ bushel; malt-house rent, £27„10, servants' wages, £36„5s., other charges, £19„15s. He sells the malt at 9/6 ⅌ bushel. Required his gain or loss, including 6 months' interest on the cost of the barley?

19. Four Tenants have a joint lease of a Farm, at £450 a year: in settling with the Steward at the term for the rent, A. paid £120, B £100, C. £75, and D. the balance. How are they to settle among themselves, that each may pay alike?

20. A Cloth Merchant values his cloth at 18/. in bartering with B., which is 12½ ⅌ Cent. above his Invoice price. Required how B. should rate his muslin, which cost 2/6 ⅌ yard, to be even with him; and what is the prime cost of the Merchant's cloth?

21. A Spirit Merchant barters with a Grocer, rum at 15/. ⅌ gallon, which cost 12/6d.; and the grocer gives him sugar at 84/. ⅌ cwt., which he bought for 75/. Required who has the advantage, and how much ⅌ Cent.?

22. A Merchant, in purchasing Goods, is allowed a discount of 7½ ⅌ Cent. on paying Cash. In consequence of quick sales and returns, he is enabled to do this every six months. He sells at 12½ ⅌ Cent. advance on the credit price. Required how much he has ⅌ Cent. ⅌ Annum?

23. A Person in Trade, in order to enlarge his capital, borrows on Bond £1500 at 5 ⅌ Cent. interest; and finds on balancing his Books at the end of the year, that his business yields him a profit of 22½ ⅌ Cent. Required how much he will clear by this money in 7 years?

24. A. purchased an assortment of Goods, and consigned them to his Agent, who sold them for £1250„10, and allowed him 7½ ⅌ Cent. *off* this sum, on recovering present payment. The freight and other charges amounted to £68„5„6; and the Agent's commission was 2½ ⅌ Cent. How much do the Net proceeds come to?

25. The Invoice price of the above Goods amounted to £985„16„8; but A. was allowed a discount of 5 ⅌ Cent. for a bill at 3 months. In 9 months after A. had made the purchase of the goods, he received the proceeds of the Account-sales, from his Agent. Required his net gain, allowing interest at 5 ⅌ Cent.?

26. A. owes B. £360, which becomes due in 9 months; but in 3 months pays him £80; and in 3 months after that, £100. Required how much longer than 9 months B. should in equity defer demanding the balance?

27. A Person purchases Goods to the Amount of £1050, which *fall due on the 4th* of September; but on the 10th of May pays

£350, and on the 16th of July £300. How much longer than the 4th of September should he retain the balance?

28. A. owes B. £730, due 4th July, and £470, on the 4th December, 1817, and they agree to settle Accounts on 1st October, 1817, by A. granting three Bills, drawn at 4, 8, and 12 months of equal sums for the principal, including interest. Required the sum of each bill?

29. An Agent sells for his Employer 30 puncheons Rum; the sales of which were made as follow: 5 pun. 530 gallons, at 3/9., due 7th March; 5 pun. 543 gallons, at 3/8., due 25th March; 10 pun. 1100 gallons, at 3/6., due 4th May; 5 pun. 540 gal. at 3/9., due 18th June; and 5 pun. 528 gals. at 4/. due 10th July. They wish to settle accounts by one payment. Required the amount of the Sales, and the average time of their falling due?

30. C. is indebted to B. £1000, which he is unable to pay him just now; but proposes to give D. four endorsed bills each of £250, at 3, 6, 9, and 12 months' date, with interest added, for the time which the bills have to run; D. will not however agree to this, and wishes the bills drawn for such sums as will enable him to obtain, by discounting them, £1000 at present due. Required the sum of each bill, according to C.'s *proposal*, and D.'s *wish*?

31. An Undertaker for digging a Canal, when he had finished a mile in length, gave in his account to the Proprietors: the Canal was 20 feet broad at top, 16 feet at bottom, and 7 feet deep: How many cubic yards should he charge, and what is the amount at 1/3 ⅌ yard?

32. A Gentleman received from his friend in the West Indies the present of a Puncheon of excellent Jamaica Rum, measuring by the gauge 106 gallons. How much of it must he sell to pay the duties, which amount to 11/4 a gallon, the price of rum of such a quality being a guinea ⅌ gallon?

33. A Person owes the following accounts: one of £63„15, due 4th August; another of £48„10, due 9th September; and a third of £27„5, due 12th October. Required at what date from 4th June he should give a bill for the whole?

34. A Traveller received in local notes 17 Five pound notes, 19 Guinea notes, and 23 Twenty shilling notes, also a bill of £30, due in 35 days, another of £27„10, due in 42 days, and another of £65, due in 56 days. For what sum ought a Country Banker to give him a bill on London, allowing the Banker 45 days' premium, and 4/2 for the stamp?

35. A Bankrupt obtains a discharge from his Creditors on the following terms: 3/4 ⅌ £ in 6 months; 4/. in 10 months; and 5/. in 16 months; but a friend offers to pay the whole composition at the average time. Required the time when the Creditors should be paid?

36. An Agent sold on the 3d February, Madder to the amount of £165, at 6 months; on the 10th, Cotton to the value of £250„10, at 4 months; and on the 21st, Ashes to the amount of £187„10, at 3 months. The Purchaser wishes to grant his note for the whole. Required the term?

37. A Merchant having occasion to remit to London, discounts

with his Banker the following bills: A.'s, £37.13.4, due in 3 months; B.'s, £64.10, due in 2 months; and C.'s, £49.5, due in 4 months: what balance is due to the Merchant, after receiving a bill on London for £156.12, at *par*, allowing the Banker ½ ℘ Cent. commission on the bills discounted?

38. A Shopkeeper sells at 1½d. ℘ shilling profit, and turns over his money every 4 months. Required his gain ℘ Cent. ℘ annum, and what his profits come to, supposing his Sales amount to £3600?

39. A Spirit Dealer bought at an Excise Sale, 130 gallons of Hollands, at 18/., and 110 gallons Jamaica Rum, at 16/.; and after reducing these spirits 1 to 5, he sold the Gin at 16/6: at what price must he sell the Rum to clear 20 ℘ Cent. on the whole?

40. An Importer of Spirits purchases on bond 10 puncheons Rum, measuring by the gauge 1050 gallons, @ 4/8; duties, &c. 11/4 ℘ gallon. He is allowed 4 months' credit on the price, but the duties are paid in cash. He reduces it by adding one gallon of water to every five of Rum, and then sells the whole @ 17/. ℘ gallon, and allows from 6 to 9 months' credit. Required his gain or loss, including Interest?

41. A Baker bought 250 quarters of Wheat for £887.10; but having sustained some damage before delivery, the seller agrees to deduct 7½ ℘ Cent. from the Invoice price: How must he sell it ℘ quarter to gain 12½ ℘ Cent., including 6 months' interest, and Cellar rent £15?

42. A Tobacconist has 4 Cwt. 1 qr. 24 lb. of Tobacco, in the leaf; bought at 11d. ℘ lb.; duty 2/3 ℘ lb.; when manufactured, it produces 150 lb. fine twist, which he sells at 4/6; 305 lb. common do. at 4/., and 120 lb. stalks at 13d.; expenses £3.10. Required his gain or loss, and how much ℘ Cent.?

43. A Draper sells Cloth at 24/. a yard, and gains 20 ℘ Cent., but markets rising, he sold the remainder of the piece at 50 ℘ Cent. profit, for £30. Required how many yards there were of it, and also the prime cost, and selling price ℘ yard?

44. A Merchant received 18 guineas for a piece of Cloth, by which he had 3/6 a yard of profit, at the rate of 16⅔ ℘ Cent. Required the length of the piece, and the Invoice price ℘ yard?

45. A Cabinet-maker being very much straitened for money, gave B., to whom he was owing an account of £13.10, a dozen of mahogany chairs, as payment of the debt, by which he lost 7½ ℘ Cent.; whereas, if he had sold the chairs at the fair market price, he would have cleared 25 ℘ Cent. Required how much did B. get the furniture under value?

46. A Gentleman purchased some Lands in the Country for £2600, bearing interest at 5 ℘ Cent. from 11th November, 1804; on the 2d of August, 1805, he paid £1000; on the 24th January, 1806, £500; and on the 11th of June following, £500. Required the balance due 25th May, 1809, deducting 5 ℘ Cent. for property-tax on the interest due at the first payment; 6¼ ℘ Cent. on that due at the second and third payments; and 10 ℘ Cent. on the interest due on the last-mentioned da

47. A Banker discounts Bills to the amount of £1,000,000 annually, on the following terms: — He takes no Bills which have longer than three calendar months to run, including the days of grace; he charges 5 ⅌ Cent. on the sum of the bill, as usual, and also ½ ⅌ Cent. in the name of commission. Required his profits, either on the supposition he pays the proceeds of the bills with Notes of his own issuing, or borrows money at 5 ⅌ Cent. for the purpose of discounting?

48. A young Gentleman, at the age of nine years, had an Estate left him of £500 a year, which was improved by his Executors, at 5 ⅌ Cent. interest, till he attained the age of twenty-one; at which time he sold his Estate at 20 years' purchase, and intends to live at the rate of £1500 annually. Required how long it will be before his money be all spent?

49. A. receives from B. in payment of a debt, a Bill on C. for £357.12; but before it becomes due C. is insolvent, and his composition is only 3/9 ⅌ £; in 14 months, B., the Endorsee, having met with considerable losses, cannot pay more than £80 at present, and 10/. ⅌ £ in 11 months, and 3/6 in 17 months. Required how much A. will lose including interest, and considering that he is allowed to prove on C.'s Effects for the full amount of his bill?

50. The Capital of a Trading Company, consisting of 39 shares, was £28,080. A. who held 3 shares, drew for his Capital, and was allowed 17½ ⅌ Cent. of profit: on receiving his money, he laid it out in the Public Funds, by purchasing in the Four ⅌ Cent. Consols, à 82¾. Required how much Stock he will hold in that Fund? and how much ⅌ Cent. he will draw for his money?

51. A. had $\frac{7}{16}$, B. $\frac{5}{16}$, C. $\frac{3}{16}$, and D. $\frac{1}{16}$, share in a Cloth Manufactory: their original Stock was £6000, which the profits of their business increased by 45½ ⅌ Cent.; and as they now mean to dissolve the Co-partnery and separate: required how much each Partner will receive, allowing D., the manager, 100 guineas for his trouble, besides his proportional share of the profits?

52. Four Merchants in Liverpool, jointly concerned in a Mercantile adventure: A. had 3 shares, B. 4, C. 3, and D. 2 shares. B. desires A., who resides in London, to effect Insurance upon Ship and Cargo, to the amount of £20,000: being unable to obtain subscriptions beyond £17,000, he employs E., an Insurance Broker, to effect the remainder; which he does. After this, A. becomes bankrupt, and E. brings an action against the other Partners for payment of the premium at 7 guineas ⅌ Cent., policy 5/6 ⅌ do., in which he succeeds, with costs to the amount of £156.9. Required how much B., C., and D., will have to pay?

53. Three Travellers met at the foot of Ben-Lomond, in Scotland, who proposed to ascend its summit to take a view. Two of them had provisions: but the third, not having provided any, proposed to share with the rest, and to pay his proportion. This being agreed to, A. furnished 5 rolls, and B. 3 rolls, which they all eat together, and C. paid 4d. as the value of his share, with which the other two

were satisfied, but quarrelled about dividing it: upon this, the affair was referred to a Justice of the Peace, who, with the assistance of an able Accountant, decided the dispute by an impartial sentence. Required their decision?

54. The National Debt, some time ago, amounted to 820 millions sterling. Required the number of shillings and guineas in that sum: and the weight of the debt in gold and silver, and in Bank of England notes; the weight of a shilling being 3 dwt. 21 grs.; of a guinea, 5 dwt. 9 grs., and of 120 one pound notes, 1 oz. Avoirdupois? How long would a person take to count it, allowing him to reckon 100 pieces or notes in a minute for 10 hours every day (Sundays excepted)? And how much ground would the debt cover in shillings, or guineas, or bank notes; the diameter of a shilling or guinea being reckoned an inch, and the dimensions of a note 8 inches by 6? How long a train would the pieces form, supposing them laid close to each other in a line? How many waggons, loaded with 1200lbs. each, would be required to carry the debt, either in silver, gold, or in bank notes? Also, how many miles would the waggons extend, allowing 30 feet to each waggon and horses? And how many vessels, of 200 tons each, would be sufficient to transport the debt in penny-pieces, and in dollars at 4/6 each; a penny-piece (of the last coinage) weighing 11 drs. Avoir. and a dollar 16 dwt. 21 grs. Troy? What is the yearly Interest of the debt, at the usual rates of 4, 5, and 6 ℘ Cent.? And how long would the Fund of 8 millions, annually improved at 5 ℘ Cent. ℘ annum, (the sum appropriated for that purpose,) be in liquidating the debt? What annuity would be sufficient to pay off the debt at *par*, in 20 years, at either 4 or 5 ℘ Cent. ℘ annum? How long would an Assessment of 9d. ℘ pound on the value of the whole Property in Britain continue, which (according to Dr. Colquhoun's estimate) amounts to £2,736,640,000? And at how much ℘ Cent. and ℘ pound must the British Proprietors assess themselves, supposing, by a generous exertion, they agree to pay off the debt at once?

APPENDIX I.

QUERIES

ON

BILLS AND MERCHANTS' ACCOUNTS.

1. Inland Bills.

1. Question. *What is meant by a Bill?*
Answer. A Bill is a Written Obligation to pay a certain Sum at a specified time.

2. Q. *How many kinds of Bills are there?*
A. Two: Inland and Foreign Bills.

3. Q. *What is an Inland Bill?*
A. A Bill payable in the same Country where it is drawn.

4. Q. *How are Inland Bills distinguished?*
A. Into Drafts, and Promissory Notes,—the former containing an Order, and the latter a Promise.

Form of a Draft.

£142..5..9 *Liverpool, 7th October,* 1829.

Two Months after date, pay to the Order of Messrs. James Blackburn and Co. One hundred and forty-two Pounds, Five Shillings, and Nine-pence, value received as advised.

To Messrs. Curtis & Robarts,
Bankers,
London.

Wells & Milbourn.

Form of a Promissory Note.

£142..5..9. *Liverpool, 7th October,* 1829.

Two Months after date, we promise to pay Messrs. James Blackburn and Co., at our Warehouse here, the sum of One hundred and forty-two Pounds, Five Shillings, and Nine-pence, value received.

Wells & Milbourn.

5. Q. *How many Persons are generally concerned in an Inland Bill?*

A. Two: the Drawer and Accepter.

6. Q. *Who is meant by the Drawer of a Bill?*

A. The Person to whom the Bill is made payable, or who receives the sum or value of the Bill.

7. Q. *Who is meant by the Accepter of a Bill?*

A. The Person on whom the Bill is drawn, and who pays the value when due.

8. Q. *What is meant by Accepting a Bill?*

A. Signing your Name under that of the *Drawer*, by which you bind yourself to pay it when due, as having received the value.

9. Q. *What is meant by Endorsing a Bill?*

A. The Holder of a Bill, before he can pay it away, when it has been made payable to his Order, must endorse it, by writing his name on the back of it, across the paper or stamp, and against the end of the line, being in effect a promise to pay (if the bill be duly presented), should the Accepter, or any of the preceding Endorsers fail.

10. Q. *How many kinds of Endorsations are there?*

A. Two: Blank and Special Endorsements.

11. Q. *What is meant by a Blank or General Endorsement?*

A. Writing your Name only on the back of the Bill.

12. Q. *What is meant by a Special Endorsement?*

A. When the Holder names the Person to whom it is Endorsed, the bill is said to be specially indorsed.

13. Q. *Which of the two Endorsements are to be preferred in remitting bills?*

A. Special Endorsement; because, should the bill fall into improper hands, the Person's name, to whom it is endorsed, must be forged before it can be negotiated, and, consequently, fraud or imposition is prevented as much as possible.

14. Q. *When the Term of a Bill is expressed in Months, whether are Calendar or Lunar Months understood?*

A. Calendar Months are always understood.

15. Q. *Explain this by an Example.*

A. Suppose a Bill dated on the 1st January, and made payable at one month after date, the term or month expires on the 1st February; and if a bill be dated on the 29th, 30th, and 31st of January, and made payable at one month's date, the term expires on the last or 28th of February in common years, but on the 29th in leap years.

16. Q. *What is understood by Days of Grace?*

A. Days of Grace are a certain number of days granted after the term of the Bill is expired.

17. Q. *How many Days of Grace are allowed in Britain?*

A. Three Days.

18. Q. *Are Days of Grace allowed on Bills drawn at sight?*

A. No: they must be either paid, or protested, when presented.

19. Q. *If a Bill falls due on a Sunday, or any Holiday, when must it be paid?*

A. On Saturday, or the day before the Holiday.

20. Q. *Is a Bill dated on Sunday considered valid?*

A. No: at least Bankers will not discount such Bills.

21. Q. *What is meant by getting a Bill discounted?*

A. To discount a Bill means to procure *Cash* for it before it falls due.

22. Q. *How is this done?*

A. By endorsing the Bill to any Person or Banking Company, who pays the money, deducting interest for the time it has to run.

23. Q. *When a Bill is made payable at so many weeks after date, how is the time of payment known?*

A. By allowing seven days to the week, and reckoning the number of days from the date of the bill.

24. Q. *What is meant by protesting a Bill?*

A. A Protest is an instrument in writing (taken by a Notary Public), in favour of the Holder of the Bill, which is not duly accepted or paid.

25. Q. *When ought a Bill to be presented for payment?*

A. Upon the last Day of Grace, and within Bank-hours.

26. Q. *When ought a Bill to be protested if not paid?*

A. The evening of the Day on which it falls due, or last day of Grace.

27. Q. *What is the consequence, should the Holder neglect to protest the Bill in due time?*

A. He loses recourse against the Drawers and Endorsers, and can sue the Accepter only for payment.

28. Q. *When ought Inland Bills not paid to be returned?*

A. Inland Bills may be kept fourteen days, but not longer.

29. Q. *How soon can payment of a Bill be enforced, after it has been protested?*

A. Charge may be given immediately; and in six days thereafter the Accepter, or his Property may be attached.

30. Q. *For what length of time is a Bill in force?*

A. A Bill continues effectual for six years, although not regularly protested; and forty years when duly protested.

2. FOREIGN BILLS.

31. Q. *What is meant by a Foreign Bill?*

A. It is a Written Order from a Person in one Country, addressed to another in a different Country, requiring him to pay a certain sum to a third person, or to his order; and that either on *demand, or at a specified time.*

FORM OF A FOREIGN BILL.*

£650 Sterling. **HAMBURGH**, *June* 2d, 1829.

At Usance, pay to the Order of Messrs. Holford, Rucker and Co. Six hundred and fifty Pounds sterling, value received, and charge the same to the Account of

Mr. Solomon Sheldon, } **MOSES REISS.**
London. }

32. Q. *What is meant by Usance?* †
A. Usance is the usual time at which Bills are drawn at certain places, such as one, two, or three months, after date or after sight.

33. Q. *How many Persons are concerned in a Foreign Bill?*
A. Sometimes three, but generally four; viz. two at the Place where the Bill is drawn, and two in the Country where it is payable.

34. Q. *How are these Persons named?*
A. The Drawer, Payee, Drawee, and Holder.

35. Q. *Who is meant by the Drawer?*
A. The Person who makes out the Bill.

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* To explain the business transacted by this Bill,— Suppose that Holford, Rucker, and Co., who reside at Hamburgh, have occasion to remit to London, and apply to Moses Reiss for a Bill on London; Reiss agrees to supply them, and draws the bill on his Dr. or Banker, Solomon Sheldon; Holford, Rucker and Co., on receiving the Bill, pay the value to Reiss, and send it their Correspondent, suppose A. B. of London, first writing on the back of the bill,

Pay Mr. A. B. or Order,

HOLFORD, RUCKER & Co.

This is called endorsing the Bill to A. B., and when he receives the Bill, he applies to Sheldon, and requires him to accept the Bill; Sheldon agrees to do so, and writes under Moses Reiss's signature, *Accepted, Solomon Sheldon,* and delivers it back to A. B., who may either keep it till it falls due, and demand payment, or he may transfer the money to another, by endorsing the bill.

† Usance between London and any part of France, is *thirty days* after date; between London and Hamburgh, Amsterdam, Rotterdam, Middleburgh, Antwerp, Brabant, Zealand, and Flanders, *one calendar month* after the date of the bill: between London, Spain, *or Portugal, two calendar months;* between London and Genoa, *Leghorn, Milan,* Venice, and Rome, *three calendar months.*

36. Q. *Who is meant by the Payee?*

A. The Person to whose order, or in whose favour the Bill is drawn.

37. Q. *Who is meant by the Drawee?*

A. The Person on whom the Bill is drawn.

38. Q. *Who is meant by the Holder of a Bill?*

A. The Person to whom the Bill is endorsed, or in whose possession it remains at the time of payment.

39. Q. *Who is meant by the Endorser?*

A. The Person who first writes his name on the back of the Bill.

40. Q. *Who is meant by the Endorsee?*

A. The Person to whom the Payee has endorsed the Bill.

41. *What is meant by a Set of Exchange?*

A. Two, three, or four Bills drawn at the same time, of the same tenor and date.

FORM OF A SET OF EXCHANGE.

No. 1.

£450 NEW YORK, *May 9th*, 1829.

Sixty Days after sight, pay this my first of Exchange, (second and third unpaid) to the order of Mr. A. B. Four hundred and fifty Pounds Sterling, value received.

Messrs. Geo. Kennedy & Co.
London. *Richard Conder.*

No. 2.

£450 NEW YORK, *May 9th*, 1829.

Sixty Days after sight, pay this my Second of Exchange, (first and third unpaid) to the order of Mr. A. B. Four hundred and fifty Pounds Sterling, value received.

Messrs. Geo. Kennedy & Co.
London. *Richard Conder.*

No 3.

£450 New York, *May 9th*, 1829.

Sixty Days after sight, pay this my Third of Exchange, (first and second unpaid) to the order of Mr. A. B. Four hundred and fifty Pounds Sterling, value received.*

Messrs. Geo. Kennedy & Co. }
London. }

Richard Conder.
Geo. Kennedy & Co.
Accepted July 13. 1829.

42. Q. *For what purpose are these Bills so drawn?*

A. To be transmitted by different Ships or Posts, as a security against accidents and delays; and when one of them is accepted and paid, the others are of no use.

43. Q. *How is the Time of Payment fixed on Bills drawn after sight?*

A. The Accepter marks the *Date* of his Acceptance, and the term of the *Bill* is computed from the time it was *accepted*, and not from the time it was drawn.

44. Q. *When ought Foreign Bills not paid to be returned to the Party from whom they were received?*

A. Foreign Bills should be returned in course of Post, or, at all events, within three Posts.

I. Bills of Parcels.

45. Q. *What is meant by a Bill of Parcels?*

A. A Bill of Parcels is a note of the quantity and value of Goods sold, and delivered by the Seller to the Purchaser, along with the Goods.

46. Q. *How is a Bill of Parcels made out?*

A. When it is a copy of the Goods sold, and delivered at the time of purchase, the expression is, Bought of A. B.

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* Bills from *America* and the *West Indies* are generally drawn at so many days' or months' sight, on account of the uncertainty of their coming to hand at any fixed time.

FORM OF A BILL OF PARCELS.

No. 1. LEEDS, *May 7th*, 1829.

Messrs. Wells & Milbourn,

By Welch. **BOUGHT** *of James Blackburn & Co*

	Nos.	*Yds.*			
Wells & Milbourn, Liverpool. 13 st.	3824	21¼	Superf. Brown ⅞ Cloth	@ 18/6	£19.13.1½
	3725	22¾	do. Bronze Gr. do.	— 20/9	23.12.0¾
	8472	24	do. Blue do.	— 24/6	29. 8.0
	6394	23½	do. Black do.	— 25/.	29. 7.6
			Canvas, &c.		. 3.6
6 *Mo. and Bill on London* @ 2 *mo.*					102. 4.2¼
			Disc. for measure 5 ℘ Cent.		5. 2.2¼
					£ 97. 2.0

No. 2. LEEDS, *May 17th*, 1829.

Messrs. Wells & Milbourn,

BOUGHT *of James Blackburn & Co.*

	Nos.	*Yds.*			
Wells & Milbourn, Liverpool. Paid. 5 st. 7 lb.	3094	40	Superf. Bottle plain	7/9 ...	£15.10. 0
	4062	39½	do. light olive do.	8/3	16. 5.10½
	3974	37½	do. Blue do.	7/.	13. 2. 6
6 *Mo. and Bill* @ 2 *mo.*			Carriage to Manchester 2/9 Canvas, &c................ 2/8½	...	. 5. 4½
					£45. 3. 9

47. Q. *If a Bill of Parcels be for Goods sold at a former period, how is it expressed?*

A. We write Mr. *C. D.* To *A. B.*; or Mr. *C. D.* To *A. B. Dr.*; and place the dates (if more than one) on the margin. This is called a General Account.

FORM OF A GENERAL ACCOUNT FOR THE PRECEDING BILLS OF PARCELS.

LEEDS, *May 2d*, 1829.

Messrs. Wells and Milbourn,

TO *James Blackburn & Co. Dr.*

May 7th.	To Amount of Goods rendered.........	£97.2.0
May 17th.	To ditto ...... ditto	45.3.9
		£142.5.9

II. INVOICES.

48. Q. *What is an Invoice?*

A. An INVOICE is an Account of Goods generally sent off by Sea, either in consequence of an Order from the Person to whom they are sent, and at his risk; or Consigned to him for Sale at the risk of the Shipper.

FORM OF AN INVOICE.

INVOICE of Loaf Sugar, shipped on board the Jane, Captain Johnson, for Jamaica, on Account and Risk of John Stirling, Esq. Merchant there.

LONDON, *April 3d*, 1829.

In 16 Puncheons.

	Cwt. qr. lbs.		Cwt. qr. lbs.
No. 1.	4 „ 2 „ 27	No. 9.	4 „ 3 „ 26
2.	5 „ 0 „ 6	10.	5 „ 0 „ 5
3.	4 „ 3 „ 17	11.	4 „ 3 „ 20
4.	4 „ 3 „ 16	12.	4 „ 3 „ 27
5.	5 „ 0 „ 1	13.	4 „ 3 „ 14
6.	5 „ 0 „ 1	14.	4 „ 3 „ 0
7.	5 „ 0 „ 19	15.	4 „ 3 „ 13
8.	5 „ 0 „ 17	16.	5 „ 0 „ 6
	39 „ 3 „ 20		39 „ 0 „ 27
	39 „ 0 „ 27		

79 „ 0 „ 19 at 92/. ℘ Cwt.	£364 „ 3 „ 7			
Cost of 16 Puncheons at 27/3 ea.	21 „ 16 „ 0	385	19	7
CHARGES.				
Entry and Agency	£ 2 „ 14 „ 6			
Shipping Charges	3 „ 9 „ 3			
Freight of 16 Puncheons at 30/.	24 „ 0 „ 0			
Commission on £416 „ 3 „ 4 at 2½ ℘ Cent.	10 „ 8 „ 1			
Insurance on £460 at 6 guineas ℘ Cent. and Policy 5/6 ℘ Cent.	30 „ 7 „ 1			
Commission on do. at ½ ℘ Cent.	2 „ 6 „ 0	73	4	11
Errors Excepted.				
	£	459	4	6

HAMILTON & GRAHAME.

N. B. For the Letter to accompany this Invoice, *see* No. II.

49. Q. *On what Sum does an Agent charge his Commission for purchasing and shipping off Goods?*

A. On the cost of the Goods, including all Charges.

50. Q. *For what purpose is the clause "Errors Excepted" prefixed to Invoices and other Accounts?*

A. That the Subscriber may have it in his power afterwards to correct errors, should any be discovered.

III. ACCOUNT SALES.

51. Q. *What is an Account Sales?*

A. It is an ACCOUNT of GOODS sold on Commission, drawn out by the Agent, and sent to his Employer, who made the consignment.

52. Q. *When the Debts are not guaranteed by the Agent, but are at the risk of the Employer, how should he make out the Account Sales?*

A. In the Preamble it may be stated at whose risk the Goods have been sold; or, the Agent should prefix to his Signature "*Bad Debts excepted;*" otherwise in strictness he becomes accountable for the same.

53. Q. *When the Agent guarantees the Debts, is it necessary to mention in the Account-Sales the Names of the Purchasers?*

A. It is not absolutely necessary, although in many instances it is done; because it is a matter of indifference to his Employer to whom he sold the Goods.

54. Q. *On what Sum does the Agent charge his Commission on an Account-Sales?*

A. On the Amount of the Sales; in other words, what the Goods sold for.

FORM OF AN ACCOUNT SALES.

SALE of Ten Bales Cotton, ℘ the Columbus, from Jamaica, on Account of John Stirling, Esq. of that Place.

		£	s.	d.
1829.				
June 10. Sold George Houston & Co.				
Bill at 4 Months.				
J. S. No. 1. 2„1„27				
2. 2„2„ 7				
3. 2„1„23				
4. 2„1„20				
5. 2„0„14				
6. 2„0„17				
7. 2„1„24				
8. 2„0„ 2				
9. 2„0„15				
10. 1„2„ 6				
Gross 22„1„15				
Tare 1„0„10				
Net 21„1„ 5 or 2385 *lbs.* at 2/1.		248	8	9
CHARGES.				
Duty on 2400 lbs. at 16/11 ℘ 100 lb....	£20„ 6„ 0			
Freight on do. at 2½d. ℘ lb................	25„ 0„ 0			
Landing charges, 9/6, shed dues, 2/4.....	11„10			
Shore rent, 10/6, Agency, 10/6............	1„ 1„ 0			
Sample room, 7/6, stamp, 5/..............	12„ 6			
Interest on Duty and Freight,.............	1„ 1„ 2			
Commission and guarantee, 4 ℘ Cent....	9„18„ 9			
		58	11	3
To John Stirling Esq. for Net Proceeds, due 13th Oct.	£	189	17	6

Errors Excepted.

HAMILTON & GRAHAME.

55. Q. *What is meant by the Net Proceeds?*

A. The Sum which remains after all Charges attending the Sales have been deducted, and which *Sum* is due to the Person from whom you received the Consignment.

56. Q. *What is the Duty of an Agent?*

A. An Agent should procure the best intelligence of the state of Trade at the Place where he resides; of the *quantity* and *quality* of the Goods in the market; their present *Prices*, and the probability of rising and falling; to pay exact obedience to the orders of his Employers; to consult their interest in matters referred to his discretion; to execute their business with all possible despatch; to be early in his intelligence; distinct and correct in his Accounts; and punctual in his correspondence.

IV. ACCOUNTS CURRENT.

. *What is meant by an Account-Current?*

A. It is the state of our Mercantile transactions with any Person, drawn out in a plain circumstantial manner, arranged in the form of *Dr.* and *Cr.*, and it exhibits the state of their affairs up to the time it is made out.

58. Q. *Does it require a knowledge of Book-keeping to understand the nature of an Account-Current?*

A. Yes; because the particulars are narrated as expressed in the Journal, and *Subsidiary Books;* and where the collective term *Sundries* occurs in the Ledger, every reference is supplied.

59. Q. *How is Interest calculated on Accounts-Current?*

A. The usual method is to compute the Interest on each Sum respectively, on the *Dr.* and *Cr.* sides of the Account; but this method, however, is very laborious without the assistance of *Interest Tables.*

The best method is to add and subtract the Sums on the *Dr.* and *Cr.* sides of the Account, as they become due; and then multiply the several *balances* by the days which intervened between each transaction; and if the balances be due at one time to the Merchant, and at another to his Correspondent, extend the products in separate columns, and compute the Interest on the difference of the Sums of these columns.

60. Q. *Why should a preference be given to this last Method?*

A. Because this method is not only more expeditious, by reducing the Calculation (by the common divisor, 7300) to one operation; but it also exhibits the *balance* due to the respective Parties at the different dates.

AN ACCOUNT

Dr. **JOHN STIRLING, Esq. Jamaica, *in Account***

1829.			£	s.	d.
Jan.	10.	To Cash, paid your Bill in fav. of Hill, this day, ...	200	14	0
Mar.	1.	To Goods ℘ the Jane, as ℘ Invoice, due 4th June,..................	459	1	1
	8.	To Cash, paid Campbell, ℘ order,.........	50	16	6
June	30.	To Commission on £251„10„6 paid, and on 450„ 0„0 received. £701„10„6 at ½ ℘ Ct.	3	10	2
		To Postages to this date,.....................		15	10
		To *Balance,* due You this date, ...	103	3	8
		£	818	1	3

LONDON, 30th *June*, 1829.

Dr. INTEREST.

	£	s.	d.
On 200„14„0 for 171 Days to 30th June,	4	14	0
... 459„ 1„1 ... 26 ...... to do..........	1	12	8
... 50„16„6 ... 114 ...... to do..........		15	10
... 189„17„6 ... 105 ...... to do. off,.....	2	14	7
Balance of Interest carried to Acc. Current.................................	1	11	0
	11	8	1

CURRENT.

Current with **HAMILTON & GRAHAME, London.** *Cr.*

1829.			£	s.	d.
Jan.	1.	By *Balance* due you at this date, ...	176	12	9
	4.	By your Bill on Louis, due 8th March,...	450	0	0
June	10.	By Net Proceeds of 10 Bales Cotton, ℘ Columbus, due Oct. 13th,...........	189	17	6
	30.	By Interest, ℘ Account annexed,.........	1	11	0
		£	818	1	3

Errors Excepted.

HAMILTON & GRAHAME.

ACCOUNT *Cr.*

	£	s.	d.
On 176„12„9 for 181 Days to 30th June,	4	7	7
... 450„ 0„0 ... 114 ...... do.	7	0	6
	11	8	1

FORMS OF MERCANTILE LETTERS

To accompany the preceding Accounts.

No. I. ORDERING GOODS.

Gentlemen, JAMAICA, 10*th Jan.* 1829.

I will thank you to purchase on my Account, about Eighty Cwt. of Fine Loaf Sugar, not to exceed 93/. ⅌ Cwt., and ship the same in strong Hogsheads by first Vessel from your Port, effecting Insurance on the lowest terms.

I rely upon your attention to my interest, and am,

Gentlemen,

Messrs. Hamilton & Grahame, *London.* } *Your most obedient Servant,*
JOHN STIRLING.

No. II. SHIPPING GOODS.

(Executing the preceding Order.)

Sir, LONDON, 4*th April,* 1829.

Agreeably to your kind order of the 10*th January, we have shipped per the Jane, Capt. Johnson, for Jamaica, Refined Sugars as ⅌ Invoice annexed, Amount with Charges and Insurance* £459„4„6, *at your Debit, payable at* 3 *months.*

This Sugar is at such a price, and of such a quality, as we trust will give entire satisfaction. Waiting your farther Commands, we remain,

Sir,

John Stirling, Esq. *Jamaica.* } *Yours very respectfully,*
HAMILTON & GRAHAME.

(This Letter to accompany the Invoice, p. 188.)

No. III. Furnishing Account Sales.

Sir, London, 13*th June,* 1829.

We have the pleasure to hand you Account-Sales of your Ten Bales Cotton, per the Columbus; Net Proceeds, £189.17.6, *due* 13*th Oct., at your Credit: which we hope you will find correct. The Drafts you intend to pass on us will meet with due honour. We are,*

Sir,

John Stirling, Esq. } *Yours respectfully,*
Jamaica. **Hamilton & Grahame.**

(This Letter to accompany the Account Sales, page 190.)

No. IV. Rendering an Account-Current.

Sir, London, 2d *July,* 1829.

Annexed you have a Copy of your Account-Current for the last six months, which we hope you will find correct: Balance in your favour £103.3.8, *which is placed to your Credit in New Account. We remain,*

Sir,

John Stirling, Esq. } *Your most obedient Servants,*
Jamaica. **Hamilton & Grahame.**

(This Letter to accompany the Account-Current, pages 192, 193.)

ADDITIONAL LETTERS.

Ordering Insurances.

Gentlemen, St. Kitts, 2*d May,* 1829.

Please to get insured for us £1800 *Sterling, on* 40 *Hogsheads Sugar, at* £25, *and on* 50 *Puncheons Rum at* £16, ℔ *the Cuba, Thomas Leaman, Master, from St. Kitts to Liverpool, consigned to your address. We are,*

Gentlemen,

Messrs. Robinson & Clow, } *Your most obedient Servants,*
Liverpool. **Fordyce & Co.**

P. S. The Cuba is expected to sail in about a month.

EFFECTING INSURANCE.

Messrs. Fordyce & Co. LIVERPOOL, 5*th July*, 1829.

Gentlemen,

*Agreeably to your desire, we have effected Insurance on your Account; £*1800 *Sterling, on* 40 *Hhds. Sugar, and* 50 *Puncheons Rum, at* 6 *Guineas ℘ Cent., to return* 3 *℘ Cent. for convoy and arrival of the Cuba, Thomas Leaman, from St. Kitts to Liverpool. We are,*

Gentlemen,

Your most obedient Servants,

ROBINSON & CLARKE.

*Premium on £*1800, *at* 6 *Guineas ℘ Cent.*	*£*113. 8.0
Policy and Duty, 5/6 *℘ Cent.*	4.19.0
Commission, ½ *℘ Cent. at your debit*.........	9. 0.0
	*£*127. 7.0

REMITTING AND DRAWING BILLS.

Messrs. Wilkinson & Sons, LONDON, 10*th May*, 1829.

Gentlemen,

Inclosed you have More's Draft on Downe & Co. at 45 *d/d. ℘ £*1000, *to retire our Draft on you, due* 14*th, the receipt of which please acknowledge in course.*

We have this day valued on you at 3 *months ℘ £*500, *in favour of Bennet and Ramsay, to which we beg your usual attention, and are,*

Sirs,

Your most obedient Servants,

WATSON & MURRAY.

ADVISING OF A REMITTANCE.

Gentlemen, LONDON, 14*th May*, 1829.

We are duly favoured with yours of the 10*th, covering More on Downe & Co. at* 45 *days, for £*1000, *which is accordingly applied as you direct.*

Your Draft in favour of Bennet & Ramsay, at 3 months for £500, has just been presented, and we have accordingly honoured your signature with our acceptance.

We are,
Gentlemen,
Your most obedient Servants,
WILKINSON & SONS.

Messrs. Watson and Murray,
London.

ADVISING OF A BILL BEING DISHONOURED

Mr. John Ramsay. LONDON, 13*th June,* 1829

Sir,

Your Draft on Smith, Thomson and Co. for £250, due the 10th, is this day returned me, under protest for non-payment, and amounts with Expenses to £254.8/. against which I will thank you for a Remittance by return of Post, and am,

Sir,
Yours respectfully,
JAMES MURRAY.

Principal,	£250. 0.0
Protest,	0. 8.0
Commission and Re-Exchange ½ ℘ *Cent....*	3.15.0
Postages,	0. 5.0
	£254. 8.0
Interest till paid,	

REMITTING FOR THE FOREGOING BILL.

Sir, LEEDS, 15*th June,* 1829.

I am this moment favoured with yours of the 13th, informing me that my Draft on Smith, Thomson & Co. due the 10th, has been returned you for non-payment.

I rest satisfied that every exertion to procure payment has been used, although without success.

Inclosed you have Hamilton and Coutts, at 50 Days, for £256.2.10, which covers the amount with Interest and Expenses. I remain,

Sir,
Yours respectfully,
JOHN RAMSAY.

RESPECTING BANKRUPTCY.

Dear Sir, LONDON, *June 27th,* 1829

In reply to yours of 16*th, I have to inform you, that Smith, Thomson & Co.'s business is winding up; how their affairs will turn out will very soon be made public.*

So soon as their Composition is ascertained, you may expect to be duly informed by,

Dear Sir,
Yours very sincerely,
WILLIAM CUNNINGHAM.

Dear Sir, LONDON, 12*th Aug.* 1829

After a minute investigation of the affairs of Smith, Thomson & Co., I am sorry to inform you that more than 5/6 *per* £ *will not be obtained, and it is even doubtful when this small composition will be realized.*

I regret that you are so deeply concerned in this failure. Any service that I can render, you may freely command it; and I remain,

Dear Sir,
Yours very truly
WILLIAM CUNNINGHAM.

LETTER OF CREDIT AND RECOMMENDATION.

Dear Sir, LONDON, 2*d June,* 1829.

This will be handed you by my friend Mr. William Johnson of Greenwich, who visits your country for the recovery of his health: I recommend him to your favour and good offices, and request you will furnish him with what money he may have occasion for, on my account, to the extent of three thousand Milrees, and transmit me his receipt for the same, and if necessary draw on me at Usance for the value.

I remain,
Dear Sir,
Yours respectfully,
GEORGE HAMILTON.

Jacob Brancomb, Esq.
Lisbon.

As a farther specimen of the style of Mercantile Letter-Writing, we shall subjoin the following correspondence; which, with the foregoing, comprehend most subjects on which men of business have occasion to write.

Messrs. Davidson & Son. GLASGOW, 1st *Sept.* 1829.

Gentlemen,

Since our last advices we have had little alteration in the prices of Wheat, and no demand whatever for exportation. Oats have been extremely dull these six weeks, yet within these few days they have begun to revive. We are of opinion, that an early Cargo would turn to advantage, our supply of this Grain being trifling. Barley, Peas and Beans have each declined a little. We annex Prices Current of the various articles of Grain and Seed imported into this market, with a few remarks for the per[illegible] of those who are interested in the Corn trade.

We are, Gentlemen,
Respectfully yours,
LAURIE & ANDERSON.

Messrs. Laurie & Anderson. BERWICK, *5th Sept.* 1829.

Gentlemen,

The state of your Markets, as conveyed to us by your letter of the 1*st inst. and for which we return you our best thanks, appears to us so favourable for a speculation, that we have already loaded a Vessel with Eight Hundred Quarters of Oats to your address.*

*The Ship is named the Fame, Capt. Lindsay, and will sail in a few days. The Bill of Lading is not yet signed, but we hope to get it before the departure of the Post. You will please insure this Parcel on receipt of the above document, to the amount of £*1100*. The sale we leave to you, yet think it necessary to observe, that the Oats stand us about* 25/. *of your Boll.*

We are, Gentlemen,
Your most obedient Servants,
DAVIDSON & SON.

P. S. *We have, since writing the above, procured the Bill of Lading which we herewith enclose.* D. *and* S.

Messrs. Davidson & Son. GLASGOW, *9th Sept.* 1829

Gentlemen,

We have received your esteemed Letter of the 5th instant, transmitting us the Bill of Lading of 800 *Qrs. of Oats, per the Fame, Capt. Lindsay, and tender you our best thanks for this mark of your friendship towards us. We are happy to inform you, that the Ship is already arrived, which consequently saves the Insurance, and leaves you a probability of a greater profit.*

We are yet ignorant of the state of her Cargo, but shall have Samples drawn for to-morrow's market, where they shall be offered, and we trust will meet with a good sale. Nothing shall be wanting on our part to promote it.

We are respectfully,
Gentlemen,
Your most obedient Servants,
LAURIE & ANDERSON.

Messrs. Davidson & Son. GLASGOW, 10*th Sept.* 1829.

Gentlemen,

Since our respects of yesterday, we have carefully examined your Oats, per the Fame. We are sorry to say that we have found them in a very damaged condition, and so very hot as to endanger their safety. Being of opinion that the operations of landing and kiln-drying, would only increase the expenses, without tending in the same proportion to enhance their value, we thought it most advisable to sell them on board, and have therefore disposed of them at the price of 22*/. per Boll, which is rather lower than we wished: notwithstanding we are convinced that a higher one could not have been obtained by delaying the sale. We feel great uneasiness that this speculation should turn out so unfortunately.*

In the course of a few days, we shall transmit you the Account-Sales. At foot is a statement of our markets for your inspection. You will observe, that the quoted price of sound Oats, is little more than we obtained for yours, which were damaged.

We are respectfully,
Gentlemen,
Your most obedient Servants,
LAURIE & ANDERSON.

Messrs. Davidson & Son. GLASGOW, 18*th Sept.* 1829.

Gentlemen,

Confirming our respects of the 10*th instant, we beg leave to hand you herewith the Account-Sales of your Oats, per Fame ; Net Proceeds £*904 . 7, *for which you shall be credited in due time. Since our last, the Purchaser has offered us one shilling per Boll to quit the bargain, convinced, as he says, that it will be a losing concern to him.*

We are, most respectfully,
Gentlemen,
Your very obedient Servants,
LAURIE & ANDERSON.

Messrs. Laurie & Anderson. BERWICK, 21*st Sept.* 1829.

Gentlemen,

We have to acknowledge the receipt of your favours of the 9*th,* 10*th, and* 18*th inst., the latter covering Account-Sales of our Oats, per the Fame. The price at which you have disposed of them, is so considerably below our expectations, that we do not hesitate to declare our entire refusal of the contract. We therefore return you the Account, claiming, at least, the price of* 25/. *per Boll.*

So much damaged as you represent, they could not possibly be, from the easy and quick voyage the vessel had ; and, had they been really so, it was your duty to inform us of it, and wait our decision, before selling them. We expect your next will favour us with your acquiescence.— In the interim, we remain,

Gentlemen,
Your most obedient Servants,
DAVIDSON & SON.

Messrs. Davidson & Son. GLASGOW, 23*d Sept.* 1829.

Gentlemen,

We are much surprised and concerned that your letter of the 21*st inst. should contain such severe expressions, hurtful to us, and unavailing to you. We feel conscious in having acted precisely conformably to your own directions. Your letter of the* 5*th, expressly* *says, "we leave the sale to you;" and many persons here of undoubted veracity, will prove, that landing and kiln-drying, would not have produced an amelioration sufficient to defray the expense. No step more conducive to your interest could have been taken; and we trust, that on mature reflection, you will find your judgment premature. We therefore take the liberty of sending you back the Account, trusting, that when you have candidly considered the case, you will not think us to blame. We are, respectfully,*

Gentlemen,

Your most obedient Servants,

Laurie & Anderson.

Messrs. Laurie & Anderson. Berwick, 26*th Sept.* 1829.

Gentlemen,

Your letter of the 23d has been duly received. In reply, we have only to say, that we strongly adhere to our first resolution, and we cannot accept the Account of the sale of Oats, ℘ the Fame, without an allowance of 3/. ℘ Boll. Our Letter of the 5th mentions, "we leave the sale to you;" it also adds, "the Oats stand us about 25/. ℘ Boll"—by adopting one expression you sanction the purport of the other. The only one we have to add, is, that we insist on the above allowance, which it is your interest to comply with, as we are determined not to settle the Account without it: we wait your acquiescence, and remain,

Gentlemen,

Your most obedient Servants,

Davidson & Son.

Messrs. Davidson & Son. Glasgow, 29*th Sept.* 1829.

Gentlemen,

To your last letter of the 26th, we shall make no farther reply, than that we can call numerous witnesses to prove we have acted as fair and honourable men. In the light of Agents and Merchants, we are not responsible for casual circumstances; neither will we attempt to impose on the world, by obstinately endeavouring to pass bad articles for good, in order to obtain the favour of our

Employers. To avoid any farther unpleasant correspondence on this business, we propose the settlement of it by arbitration. And are,

Gentlemen,

Your most obedient Servants,

Laurie & Anderson.

Messrs. Laurie & Anderson. Berwick, *5th Oct.* 1829.

Gentlemen,

As we are willing to accept the proposal, mentioned in yours of the 29th ult., of settling our dispute by arbitration, we have, to this end, sent copies of all the papers relative to the transaction, to our friend Mr. Hamilton, of your place, whom we have empowered to act and decide for us. He will communicate to you our intentions, which we fully confirm. We are,

Gentlemen,

Your most obedient Servants,

Davidson & Son.

APPENDIX II.

DUODECIMALS.

OR

CROSS MULTIPLICATION.

Duodecimals, or Cross Multiplication, is used by Artificers in computing the contents of their work.

Rule. First. *Multiply each denomination of the length by the* Feet *in breadth, and place each Product under the denomination of the Multiplicand, from which it arises,—carrying by* 12.

Next. *Multiply by the* Inches, *and set each product one place farther to the right hand.*

Lastly. *Multiply by the* Parts, *or* 12*ths of an inch, and set each product another place towards the right hand.*

Note. The twelfth part of a superficial foot is termed by Artificers an inch, and is divided into 12 parts, each part into 12 seconds, and these again subdivided as far as necessary, the value of the places regularly decreasing by a scale of 12.

Exam. Multiply 7 Feet 6 Inches by 5 Feet 9 Inches.

By the Rule.		*By Aliquot Parts.*	
Length	7 . 6	6 in ½	7 . 6
Breadth	5 . 9		5 feet.
	37 . 6		37 . 6
	5 . 7 . 6	3 in ½	3 . 9
Super. content	43 . 1 . 6		1 . 10 . 6
		as before,	43 . 1 . 6

Note. If the measure be given in *yards*, or any other denomination greater than feet, we may reduce it to feet, and multiply: then find the yards in the quotient.

EXERCISES.

	Ft.	in.		Ft.	in.		Ft.	in.	pts.		Ft.	in.	pts.
1. Multiply	3	4	by	2	1	7. Multiply	9	8	0	by	8	7	0
2.	4	5	by	3	2	8.	10	9	0	by	9	8	0
3.	5	6	by	4	3	9.	11	11	11	by	11	11	11
4.	6	5	by	5	4	10.	12	10	6	by	7	8	9
5.	7	6	by	6	5	11.	14	6	9	by	9	0	3
6.	8	7	by	7	6	12.	15	4	3	by	12	6	4

Superficial Measure respects the surface of any thing, and is found by multiplying the length by the breadth.

Solid Measure is computed by multiplying the length by the breadth, and the product by the thickness or depth.

EXERCISES.

13. What is the measure of a Court, 6 yards, 2 feet, 6 inches long, and 4 yards, 2 feet broad?

14. What is the measure of a Carpet, 7 yards, 1 foot, 4 inches long, and 5 yards, 2 feet, 3 inches broad?

15. What is the measure of a Road, 750 yards in length, and 16 feet, 6 inches, in breadth?

16. What is the measure of a Garden, 90 yards, 1 foot long, and 36½ yards broad?

¶ 17. Required the solid contents of a Box, 5¾ feet long, 4½ feet broad, and 3¼ feet deep?

18. Required the cavity of a Pond, 76 yards, 2 feet long, 35 yards broad, and 3 yards, 9 inches deep?

19. Required the cavity of a Well, whose surface measures 9 square yards, 5 feet, and depth 28½ fathoms?

20. Required the solid contents of a Cistern, 12 feet long, 9 feet *broad, and 6* feet deep, and how many ale gallons (old measure) *will it contain?*

PROMISCUOUS EXERCISES.

1. How many superficial feet in the floor and ceiling of a Hall, 72½ feet long, by 36 feet 9 inches?

2. How many square yards in the walls of the above Hall, being 15 feet high?

3. How many cubic or solid feet within the same Hall?

4. How many square quarters are contained in a Handkerchief ⅞ths wide?

5. How many Bank Notes, which measure 7¾ inches by 4½ inches, will cover a dining table, 12 feet by 6 feet?

6. How many guineas or shillings, allowing the diameter of each to be an inch, can be placed on the surface of a Round table, 3 feet 6 inches in diameter?

7. How many oranges, each 2½ inches round, will a Chest hold whose dimensions within are 4 feet long, 2½ broad, and 18 inches deep?

8. How many gallons, either of ale or wine (old measure), are contained in a Cubic foot of water?

9. How many square yards in the area of Solomon's Temple, whose dimensions are mentioned in 1 Kings, chap. vi., reckoning the cubit to be 18 inches?

10. The length of Noah's Ark was 300 cubits, the breadth 50, and the height 30: how many cubic yards did it contain; and how many horses might have lodged in it, allowing 10 yards to each horse?

11. The *hold* of a Vessel is 120 feet long, 33 broad, and 6 deep; how many bales of goods, each measuring at an average 6 feet by 4, and 3 feet deep, may be stowed in her, leaving a *gang-way* 3 feet broad?

12. How many square feet of board are required to make a Box 3½ feet long, 2 feet broad, and 20 inches deep?

TIMBER MEASURING.

Timber measuring is the method of measuring all kinds of timber, such as planks, logs, trees, &c. and ascertaining the number of square or solid feet contained in them.

The dimensions are taken by the carpenter's foot rule, by a tape, line, or measuring rod, as best suits the Measurer's purpose.

I. Measuring Boards, or Planks.

To find the superficial content of a Board or Plank.

Rule. *Multiply the length by the breadth: the product is the superficial content.*

Note. When the board tapers, add the breadths taken at both ends, and multiply the length by half the sum.

Example. How many square feet in a board, 17½ feet by 8½ inches?

Method 1.	Method 2.	Method 3.
17.6	½ 17.5	⅓ 17.6
8½	8.75 6 in.	5.10=4 in.
140.0	⅓ 2.91666=2 in.	⅛ 5.10=4 in.
8.9	¼ .72916=½ in.	8.9=½ in.
12)148.9	Ft. 12.39583	12.4.9
t. 12.4.9	12	
	in. 4.75	
	12	
	pts. 9.0	

EXERCISES.

1. How many square feet in a board, 14½ feet by 15 inches?
2. How many square feet in a plank, 19⅝ by 10½ inches?
3. Required the square feet in a deal, 31¾ feet by 8¾ inches?
4. Required the square feet in a deal, 37½ feet by 14¾ inches?
5. What is the content of a board 16½ feet long, 25 inches at the one end, and 18 inches at the other?
6. How much in length of a deal 7½ inches broad, will make a square foot?
7. How much in length of a board 8¾ inches broad, will make a square foot?
8. What is the price of a board, 13 feet 2 inches by 19½ inches, at 7½d. ℔ square foot?
9. Required the square feet, and price, at 2/4½ ℔ foot, in 7 oak planks, each 23½ feet long; and their several breadths as follow: four of 13½ inches in the middle; one of 14½ inches; and the other two each 16 inches at the broader end, and 13¾ inches at the narrower.

II. Measuring Logs.

Square, or four-sided timber, such as logs, &c. are measured by the solid or cubic foot, of 1728 solid inches.

When the log is equally broad, and equally thick throughout, the dimensions may be taken any where. When it tapers uniformly from one end to the other, take the breadth and thickness in the middle, or at both ends; but in this case, take half the sum of the breadths for the mean breadth, and half the sum of the thickness for the mean thickness.

To find the solid Content of squared, or four-sided Timber.

Rule. *Multiply the length, breadth, and thickness together; the product gives the solid content.*

Note. Measurers, in taking the dimensions, consider the *arithmetical mean* as the side of the square, that is, half the sum of the *breadth and thickness.*

Example. How many solid feet in a Log 19½ feet long, and 10 inches the side of the square?

Method 1.

ft. in.
19 , 6
10 in. breadth.
16 , 3 sq. content.
10 in. thickness.
Ft. 13 , 6 , 6 solid content.

Method 2.

Or, 2 in. ⅙ | 19.5 feet.
off, | 3.25
2 in. | 16.25
off, | 2.7083
Feet. | 13.5416

EXERCISES.

1. How many solid feet in a Log of Timber 31 feet long, and its mean breadth and thickness 18 inches?

2. How many cubic feet in a Piece of Wood, 24½ feet long, and 12 inches square?

3. Required the solid feet in a Log, whose length is 17½ feet by 11 inches broad, and 11 inches thick.

4. Required the cubic feet in a Log, 21¾ feet by 15½ inches the side of the square.

5. Required the solid content of a Log, 49½ feet long, and 9½ inches square at each end.

6. Required the solid content of a Log, 29¾ feet long, and 13½ inches the side of the square?

7. Required the solid content of a Log of Mahogany, 13 feet 10 inches long, and 2 feet 1¼ inches the side of the square.

8. Required the solid content of a Piece of Timber, 19¼ feet long, and 12¼ inches square.

9. How many solid feet in a Piece of Timber, 20 feet 5 inches long, 17½ inches broad, and 10 inches thick?

10. Required the solid feet in 4 Logs of Wood, the first 18 feet by 18 inches; the second 15½ feet by 20½ inches; the third, 29¼ feet by 15¾ inches; and the fourth, 37 feet by 21 inches; each of them is 20 inches thick, and the price at 4/3 ⅌ solid foot.

11. Ten Fir Planks, each 14 feet long, 3 inches thick, and 11 inches broad, at 6/8 each, cost £3,6,8; how much is that ⅌ solid foot?

12. What cost Fir Planks, 12 feet long, 1¼ inches thick, and 9 inches broad, ⅌ square and solid foot, at 2/8 each?

13. How much will Deals cost ⅌ square, and solid foot, 12 feet long, 9 inches broad, and ½ inch thick, at 15d. a piece?

14. How many square and solid feet in 20 Planks of Fir, each 14 feet long, 3 inches thick, and 11 inches broad; how much will they cost at 6/8 a piece, and what do they stand the Purchaser ⅌ square and ⅌ solid foot?

15. How many Loads, each 50 cubic feet, in 30 Memel Logs, the length of 10, being 19 feet 4 inches, girt 58 inches; the length of 14, 22 feet, 2 inches, girt 62 inches; and the rest 30 feet 1½ inch, girt, 66 inches; and what is the price at £4,17,6 ⅌ load?

Note. Memel Logs are generally hewn square, or nearly so; and they taper very little. The common method of measuring them is, to girt them in the middle with a line, and to take a ¼ of the girt for a side of the square.

III. Measuring Trees.

Trees, or round Timber, are also measured by the solid foot; the dimensions are taken by girting the Tree, and taking ¼ of the girt for the side of the square.

When the Tree tapers regularly, the girt may be taken at the middle, or at both ends, in which case half their sum will be the mean girt. When the Tree is very irregular, the girt may be taken at several places, equally distant, and their sum divided by the number of girts: or, divide the Tree into several lengths, according to the irregularity of the Tree: find the content of each length separately, and their sum will be the whole content of the Tree.

In measuring Trees *for sale*, that have their bark on, a deduction is made to the Buyer. Thus, in Oak, $\frac{1}{10}$ or $\frac{1}{12}$ part of the circumference is deducted. In Elm, Beech, Ash, &c., the allowance should be less, as the bark is not so thick; some Measurers insist on 1 inch out of the fourth of the whole girt; but in growing timber, half an inch is deducted from the quarter girt.

To find the Solidity of round or unsquared Timber.

Rule. Multiply the square of the quarter girt, or ¼ of the mean circumference, by the length of the Tree, and the product gives the solidity.

Note. This method, though universally used by Measurers, gives the content about ¼ less than that found by considering the Tree as a cylinder, or the content will be nearly the same as if the Tree was hewed square.*

Example. In a Tree 20 feet long, and 60 inches in girt, how many solid feet, by the common Rule, and also by considering the Tree as a cylinder.

1. By the Common Rule.

¼)60 girt.
$15^2=225$ sq. of the quarter girt.
Feet 20 length of the Tree.
144)4500 sq. inches.
Ans. 31¼ feet by the Rule.

Decimally.
Or, 15 in. $=1.25^2=1.5625$ sq. ft.
20 feet.
Feet 31.25 *as before.*

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* The true Rule of finding the solid content of a Round Tree, is the same as that for finding the solidity of a cylinder, taking the girt for the circumference of the cylinder. Thus,

Multiply .0795775 *by the square of the girt, and the product by the length of the tree.*

The above *decimal* is the area of a circle, whose diameter is 1; *and the* area of circles are one to another as the squares of their *circumferences.*

2. By considering the Tree as a cylinder.

60 inches = 5 feet.

As 1^2 : .0795775 : : 5^2 or 25

Multiply by 25

1.9894375

20 length of the Tree.

Content accurately 39.7887500 feet.

Content by the Rule 31.25

Difference 8.53875 feet too little.

EXERCISES.

1. How many solid feet in a Tree, 24 feet long, and 68 inches in girt?

2. How much Timber in a Tree, 27 feet long, whose girt at one end is 49 inches, and at the other, 34 inches?

3. How much Timber in a Tree 84¼ feet long, whose girt taken at both ends is 159 inches?

4. Required the price of 6 Elm Trees, the 1st, 14 feet 3 in., girt 50 in.; the 2d, 17 feet 2 in., girt 48 in.; the 3d, 19 feet 4 in., girt 46 in.; the 4th, 22 feet 4 in., girt 45 in.; the 5th, 23 feet 5 in., girt 43 in.; in the 6th, 27 feet 7 in., girt 41 in., at 5/4 ℘ solid foot?

5. How much in length of a Tree, 40 inches in girt, will make a solid foot?

6. How much in length of a Tree, 46 inches in girt, will make 7½ solid feet?

7. How much must be cut off a piece of Timber 20 inches broad, and 16 inches thick, to make 5 solid feet?

8. A Wood Merchant bought an Oak Tree, 24 feet, 8 inches long, and 74 inches in girt, at 4/9 ℘ solid foot, computed by the common Rule. He sold it next day at the same price ℘ foot, but the Tree was measured as a cylinder. Required his gain?

9. Required the solid feet in a Tree 11 feet, 2 inches long, and 40 inches in girt, deducting 2 inches on the girt for the bark?

10. Required the solid feet in an irregular Beech Tree, whose thicker end is 6 feet, by 50 inches in girt, and smaller end, 5 feet, by 35½ inches in girt, allowing ½ inch upon the quarter girt for the bark?

ARTIFICERS' WORK.

ARTIFICERS compute the contents of their work by several different measures.

Mason-work is generally measured by the foot, either superficial or solid. In some places by the rood of 63 square feet.*

Brick-work is measured either by the square yard, or by the rod of 272¼ square feet. The standard thickness is the length of one brick, and the breadth of another, or 14 inches.

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* *Vide* Table IX. p. 5.

Carpenter and Joiner-work, by the square of 100 superficial feet, or or by the lineal, square, or cubic yard.

Tiling and Slating are measured either by the square yard, or by the square of 100 superficial feet.

Painting and Plaister-work ; also *Paving and Causewaying*, by the square yard. — *Glazing*, by the square foot.

Digging for Vaults or Sunk Stories, is charged by the cubic yard.

EXERCISES.

1. How many roods in a Ruble Wall, 112 feet long, 28 feet high, and three feet thick, reduced to two feet thick, and what is the expense at £1.15 ⅌ rood of 60 feet ?

2. What is the expense of a Pavement, 125 feet long, and 8½ feet broad, at 5/6 ⅌ square yard ?

3. What is the expense of digging the Foundation and Sunk Story of a House, 54 feet long, 35 broad, and, at an average, 9½ feet deep, at 13½d. ⅌ cubic yard ?

4. How many rods of standard brick-work in a Wall, 184 feet long, 16 feet high, and two bricks or 18 inches in thickness ?

5. How many bricks, each 9½ inches long, 4½ broad, and 3 inches thick, including mortar, will build a wall 240 feet long, 10 feet high, and 14 inches thick ?

6. How many stones, 30 inches by 18, will pave an Area 250 feet long, and two yards broad, and what is the expense @ 13½d. a square foot ?

7. How many bricks will build a Garden Wall, 140 yards long, and 80 broad : the height of the wall to be 10 feet, and of standard thickness, allowing 140 bricks to build a square yard ?

8. How many feet of Hewn Work in three pair jambs, each 6 feet by 2 ; the lintels of do., 4 feet, 5 in., by 15 in. ; 3 inner hearths, each 3 feet, 1 in., by 18 in. ; 3 outer do., 3 feet, 8 in., by 20 in. ; a pair of kitchen jambs, 8 feet, 8 in., by 2 feet, 3 in. ; lintel of do., 5 feet, 8 in., by 15 in. ; Hearth, 4 feet, by 21 inches ?

9. How many yards of roofing and serking, in a Roof 45 feet, 8 in. long, from skew to skew ; and 21 feet, 8 in. deep, from ridge to easing, including 9 inches for wall plates or double eave ?

10. How many yards and squares of joisting and flooring, in a House of 3 floors, 45 feet by 28 within walls, allowing 9 inches for the rest of the joists, and deducting from each floor the vacancy for the stair, 12 feet by 8 ; and what is the expense of flooring, at 83/4 ⅌ square, and the joisting at 4/2 ⅌ yard ?

11. How many deals, 15 feet long and 6 inches broad, will floor a Room, 33 feet, 9 inches, by 22 feet, 6 inches, deducting a vacancy of 7½ feet by 6½ feet ?

12. Required the value of a Sash Window, measuring 6 feet, 8 in., by 3 feet, 10 in., including the cheeks, at 2/10 ⅌ foot ?

13. How much timber in a Floor 60 feet long, and 19 broad, constructed with beams, resting one foot at each end in the side walls ; the beams are 10 inches by 9, at 9 feet, 3 inches distance, and crossed *scantlings, 9 inches* by 3, resting 4½ inches, at 15 inches distance ?

14. How much should be charged for the Square, or Yard, superficial measure, so as to yield 3/9 ℘ cubic foot?

15. How much slating in a Roof, whose length is 46 feet 6 inches, depth from ridge to easing, 21 feet 3 inches, (including the allowance of 9 inches for double easing,) and what is the expense at £3,5 ℘ square?

16. How many slates will cover a Roof, measuring 48½ feet in length, and 18 feet 3 inches, from ridge to easing, (without the usual allowance,) allowing 1400 slates to the rood, and what will they come to at 70/. ℘ thousand?

17. How much tiling in a Roof, 42 feet 9 inches long, and 18 feet from ridge to easing, including 6 inches for eave, and what is the expense at 2 guineas ℘ square?

18. How many tiles will cover the same Roof, allowing 450 tiles to the rood, and what will they come to, at 7/6 ℘ 100?

19. How much plastering in a Room, measuring 105 feet 9 inches in circuit, (vacancies deducted,) and 12½ feet high; and what is the expense, at 7d. ℘ yard for the walls?

20. Required the expense of the ceiling of said Room, whose length is 36 ft. 9 in., and breadth 24 ft. 3 in., at 8d. ℘ yard?

21. Required the expense of a Cornice, 127 feet in length, (and 6 inches in projection,) at 6½d. ℘ lineal foot?

22. Required the expense of painting the outside of 12 Windows, each 7 feet, by 3 feet 6 in., at 10d. ℘ yard?

23. How many square feet in the floor, walls, and roof of a Room 36 feet long, 24 feet broad, and 12 feet high?

24. How many superficial feet of one inch in thickness, in a Log of Mahogany 12 feet long, 23 inches broad, and 18 inches thick, allowing 2 inches for the draught in sawing?

25. A Carpenter engages to make a Cistern 14 feet long, 7 broad, and 5 deep, at the rate of 1/8 ℘ square foot, what is the charge; and what will the Plumber's bill come to, who is to line it with lead at 4½d. ℘ lb. allowing 7½ lbs. to each square foot?

26. A Floor 57 feet 6 inches by 28 feet, is to be laid with deals uniformly 10 feet 6 inches by 8½ inches; how many deals will it require, allowing one-half inch in breadth for seaming, and what is the expense at 6 guineas ℘ square of 100 feet?

27. A Room 33 feet 9 inches by 24 feet 8 inches; the height from the belt to the cornice is 9 feet 9 inches, which is to be lined with paper 21 inches broad; how many yards will it require? and how much is the expense @ 10½d. ℘ yard?

28. A Maltster has a Kiln 18 feet square, which he intends to take down, and build a new one which shall be 24 feet in breadth, and to dry three times as much as the old one: required its length?

SQUARE ROOT.

To extract the Square Root of any number, is to find the side of a Square figure: or a Number, which being multiplied by itself, will produce the number proposed.

Thus, the Square Root of 16 is 4, because 4 squared or multiplied by 4=16, the given number.

Rule 1. *Divide the given number into periods of two places each, by placing a dot above every second figure, beginning at the unit's place. The number of periods shows how many places there are in the root.*

2. *Find by trials the nearest root of the first period, which set in the quotient, subtract its square from that period, bring down the next period to the remainder for a new dividend.*

3. *Double the quotient for a new divisor, and inquire how often it can be had in the dividend, without the unit's place, and annex the quotient-figure both to the new divisor and former quotient.*

4. *Multiply the divisor thus increased, by the last found figure in the quotient, and subtract the product from the dividend. Bring down the next period to this remainder, and proceed as before.*

EXAMPLES

1. Req.,the Square Root of 2916.

$\dot{2}9\dot{1}6$(54 root.
5×5=25
104)416
416

54×54
54
216
270
2916 Proof.

2. Req. the Square Root of 784.

$7\dot{8}4$(28 root.
4
48)384
384

Elucidation. If the product exceed the dividend, we must subtract 1 from the quotient; and if it still exceed, we must diminish the quotient still by 1 and try it again till it answers. Thus in Ex. 2. we can get 4 nine times in 38, but 49 multiplied by 9, would exceed the dividend: therefore we subtract 1, and try 8, which answers.

3. Req. the Square Root of 2.712.

$2.\dot{7}1\dot{2}0$(1.646+root.
$1^2=1$
26)171
156
324)1520
1296
3286)22400
19716
2684

4. Req. the Square Root of $5.\dot{3}$.

$5.\dot{3}3$(2.309+root.
$2^2=4$
43)133
129
4609)43333
41481
1852

Remarks. If there be a *remainder* after all the periods are brought down, the Root may be continued to a decimal, by annexing periods of ciphers, to any degree of exactness required; but the root can never be exactly completed; for any fraction, *or mixed number*, multiplied in itself, produces another fraction

EXERCISES.

1. Required the Square Root of 6084.
2. .... of 363699.
3. .... of 1669264.
4. .... of 194481.
5. .... of 203461696.
6. .... of 42852312064.
7. Required the Square Root of 1234321.
8. .... of 54990.25.
9. .... of .00032754.
10. .... of $.\dot{4}4$.
11. .... of $1320.\dot{1}$.
12. .... of $\frac{169}{196}$ and $\frac{289}{361}$.

APPLICATION.

First. *To find the mean proportional between two numbers: Multiply the two given numbers together, and extract the Square Root of the product.*

EXERCISES.

1. Find the mean proportional between 3 and 12?

2. Required the mean proportional between 4 and 48?

3. In a pair of scales, a Cheese weighed 64 lbs. in one scale, and only 49 lb. in the other, required its true weight?

4. Required the proportion of the length of the two arms of the above Balance on each side of the point of suspension?

Secondly. *To find the side of a square of equal content with any given superficies: Extract the Square Root of the number expressing the superficies of the given figure.*

EXERCISES.

5. There is a round Floor, which measures 272¼ square feet: required the side of a square floor equal to it in area?

6. A person wishes a Garden in the form of a square, which shall contain exactly an acre of ground: required the length of one of its sides?

7. Required the side of a Square, equal in area to a circle containing 3 acres?

8. A fish Pond contains 19 acres 30 perches: how many yards in the side of a square of equal content?

Thirdly. *To increase or diminish a circle in any given proportion: Square the diameter, enlarge or diminish it in the proportion required, and extract the square root thereof.*

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or mixed number; and, therefore, the *root* of an integer, which cannot be expressed in integers, can never be expressed in fractions.

2. Roots of *decimals* are extracted like those of integers, by annexing periods of two ciphers to the remainders. But if the decimal repeat, periods of the repeating figure are annexed to the remainder instead of ciphers. See Ex. 4.

3. Roots of *vulgar fractions* are found by extracting the *roots* of the numerator for a new numerator; and the root of the denominator for a new denominator. But if the root of either the numerator or denominator cannot be found without a remainder, reduce the vulgar fraction to a decimal, and then extract the root.

EXERCISES.

9. A Malt Kiln, whose diameter is 12 feet, dries 3 quarters of barley at a time: what must be the diameter of another which dries 4½ quarters?

10. The diameter of the Imperial Bushel is 19½ inches, and its depth 8¼ inches: required the diameter of a bushel of the same content, whose depth is only 7½ inches?

11. A Pipe of 6 inches bore will be 3 hours in running off a certain quantity of water: in what time will 4 pipes, each 3 inches, be in discharging double the quantity?

12. There are two circular Ponds in a Gentleman's pleasure-ground; the diameter of the less is 30 yards, and the other is twice as large: required its diameter?

Fourthly. *To find any side of a right-angled triangle: 1. For the hypothenuse (or slanting side) extract the Square Root of the sum of the squares of the base and perpendicular. 2. For the perpendicular, extract the Square Root of the difference of the squares of the hypothenuse and base. 3. For the base, extract the difference of the hypothenuse and perpendicular.*

EXERCISES.

13. The wall of a Fortification is 108 feet high, and a ditch surrounding it 81 feet wide: required the length of a scaling ladder that will reach from the opposite side of the ditch to the embattlements?

14. A line stretched from the top of the Monument in London to a station 150 feet from the centre of the base measured 84 yards: required its height?

15. A Ladder 40 feet long may be so placed upon one side of a street that it will reach a window 32 feet from the ground; and, without moving it at the bottom, it will reach a window on the other side, 24 feet high: what is the breadth of the street?

16. Two Travellers depart from an Inn in Glasgow: A. proceeds to Edinburgh, which is 44 miles east from Glasgow; B. to Peebles, which is exactly south from Edinburgh, and 49 miles in a straight line from Glasgow: how far are they distant on their arrival; or what is the distance between Peebles and Edinburgh?

CUBE ROOT.

To extract the Cube Root of any Number, is to find the side of a solid figure whose length, breadth, and thickness are equal: or a number which being multiplied by itself, and that product again by the same number, will produce the proposed number.

Thus, the Cube Root of 64 is 4, because 4 cubed or multiplied by 4, *and that product* by 4 = 64, the given number

Rule 1. *Divide the given numbers into periods of three places*, beginning at the place of units, and pointing to the left in integers, and to the right in decimals.*

2. *Find the nearest root of the first period, which set in the quotient, subtract its cube from the period, and bring down the next period to the remainder for a new dividend.*

3. *Find a divisor, by multiplying the square of the part of the root found by 300, divide the dividend by it, and place the quotient figure for the second figure in the root.*

4. *Multiply the part of the root formerly found by the last figure placed in the root, and this product by 30; which place under the divisor, under which write the square of the figure last placed in the root.*

5. *Multiply the sum of these three by the figure last placed in root, and subtract the product from the dividend: to the remainder annex the next period for a new dividend, with which proceed as before.*

Note. When there are decimals, each period must consist of *three* decimal places; and if the given decimal has not so many places, the deficiency must be supplied by annexing ciphers. *See* Ex. 2.

Exam. 1. Find the Cube Root of 262144.

$\dot{2}62\dot{1}44$(64 root. *Answer.*
$6^3=216$
46144 Proof.
$6^2\times300=10800$ $64\times64\times64=262144$.
$6\times4\times30=$ 720
4^2 16
11536)46144.

Elucidation. The nearest root of 262, the first period, is 6, which we set in the quotient as the first figure of the root sought, and subtract 216 its cube, which leaves a remainder of 46, to this we bring down 144, the next period, which makes 46144. The square of 6, multiplied by 300, is 10800 the divisor, and the dividend divided thereby quotes 4; then 4 times 6, multiplied by 30, is 720, and the square of 4 is 16. The sum of these three numbers is 11536, and being multiplied by 4, gives 46144, the same as the dividend: the root therefore is exactly 64.

Exam. 2. Required the Cube Root of 28¾, or 28.75

270000 $\dot{2}8.75\dot{0}$(3.06, &c. root.
5400 27
36 1750000
$275436\times6=1652616$
97384

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* The reason why we divide the given number into periods of *two* places in extracting the *Square Root* and into periods of *three* places in the *Cube Root* is, that the square of any single digit never exceeds *two* places, nor the cube *three* places. Thus, the square of 9 (the highest digit,) is 81; and the cube of 9=729.

EXERCISES.

1. Required the Cube Root of 1728.
2. .... of 373248.
3. .... of 41063625.
4. .... of 27270901.
5. .... of .010648.
6. Required the Cube Root of 1141166.125.
7. .... of 56.5.
8. .... of .9.
9. .... of $\frac{1331}{3375}$.
10. .... of $\frac{343}{512}$ and $\frac{729}{2197}$.

APPLICATION.

First. *To find the proportion of solid bodies: All solid bodies are in proportion to each other as the cubes of their diameters, or similar sides.*

1. An iron Ball of 4 inches diameter weighs 9 lbs.: what is the weight of another, whose diameter is 8 inches?

2. If a Vessel of 100 tons burden be 64 feet long in the keel; required the tonnage of another similarly built, whose keel is 96 feet long?

3. If 64 grains of gold gild a wooden Ball which weighs 27 lbs.; how many grains will gild another which weighs 343 lbs.?

Secondly. *To find the side of a cube equal in solidity to any given solid: Extract the cube root of the solid content.*

4. A Stone of a cubic form contains 21952 solid feet: what is the area of one of its sides?

5. The solid content of a Globe is 15625 cubic inches: required the side of a cube of equal solidity?

6. Required the side of a cubical Mound equal to one 288 feet long, 216 broad, and 48 feet high?

7. Required the side of a cubical Vessel that will contain a hogshead of wine, Imperial, or new measure?

8. A carpenter agrees to make a maltster a cubical Bin, to hold 64 quarters of barley, new measure: required the length of one of its sides?

Thirdly. *To find the dimensions of a solid body, having those of another given, either greater or less: Cube the dimensions respectively; enlarge or diminish them in the proportion required, and extract the Cube Root of the result.*

9. A leaden Ball, 4¼ inches diameter, weighs 17 lbs.: required the diameter of a ball of the same metal, which weighs 64 lbs.

10. The side of a cubical Altar is 1 cubit: required the side of another of the same form, and of twice that size?

11. A Cistern, 125 inches long, 64 inches broad, and 27 inches deep, contains a certain number of gallons: required the dimensions of another of a similar form which will hold three times as much?

12. A distiller has a Bin 17 feet long, 10 broad, and 8 deep, which holds 122½ quarters of barley, but he wishes a similar one which will hold 490 quarters: required its dimensions?

SUPPLEMENT;

CONTAINING

ANSWERS TO ALL THE QUESTIONS AND EXERCISES

IN THE PRECEDING WORK.

NOTATION AND NUMERATION.

CASE I. *Exercises*, Page 13.

1. Seventy-three; seven hundred and three.
2. Seven hundred and thirty; seven thousand three hundred.
3. Forty-six thousand and fifty.
4. Five hundred and eighty-six thousand and forty-one.
5. Six millions, nine hundred and seven thousand, and thirty-nine.
6. Seventy millions, eight hundred and seven thousand, five hundred and three.
7. Eighty-seven millions, sixty thousand, and forty-two.
8. Nineteen millions, one hundred and seventy-five thousand, four hundred and seven.
9. Three hundred and sixty-five millions, seven thousand, three hundred.
10. Four thousand nine hundred and eight millions, four hunderd and forty-three thousand, and one.
11. Sixty-one thousand two hundred and thirty millions, five hundred and six thousand, and seventy-eight.
12. Nine hundred and eighty-seven thousand six hundred and fifty-four millions, three hundred and twenty-one thousand, and ninety.
13. One billion, two hundred thousand three hundred millions, four hundred thousand, and five hundred.
14. Eight billions, one hundred and ninety-five thousand millions, seven thousand, and one.
15. Five hundred billions, seven hundred and five thousand and sixty millions, eight hundred and five thousand, and three.
16. Nine thousand two hundred and eight billions, three hundred and nine thousand four hundred and ten millions, three hundred and seventy-nine thousand, nine hundred and ninety-nine.

CASE II. P. 13.

1. ...... 611,788 inhab.

2. ...... 9,538,827 inhab.
3. ...... 1,805,688 ....
4. ...... 4,500,000 ....
5. ...... 16,456,303 ....
6. ...... 27,267,148 ....
7. ...... 780,952,381 guineas.
......16,400,000,000 shil.
8. ...... 2,736,640,000 pounds.

ADDITION. P. 16.

1. .... 3591 pounds.
2. .... 4257 guineas.
3. .... 42591 yards.
4. .... 24069 ells.
5. .... 10545 tons.
6. .... 54320 cwts.
7. .... 98760 stones.
8. .... 467111 lbs.
9. .... 36267 miles.
10. .... 38914 acres.
11. .... 26561 gallons.
12. .... 133143 bushels.

Additional Exercises.

1. 5036
2. 45655
3. 4155
4. 21044
5. 5263704
6. 63265801
7. 101119
8. 1682204
9. 13818
10. 13397

Questions. P. 17.

1. .... 973113 inhab.
2. ....16456303 do.
3. .... 181 days.
4. .... £5355
5. .... £1299
6. .... 803 quarters.
7. .... 1368 galls.
8. .... £1474840
9. Whole time, 2047 yrs.
10. ....£11095079

COMP. ADDITION. P. 19.

Borrowed.........£3962„18„ 9½
Paid.................£1652„ 6„ 3¼
Lent................. 8307„14„11
Received............ 2182„17„ 4
Owing by .... 5633„ 1„ 6½
Owing to. .... 4896„ 8„ 2

Troy Weight. P. 20.

71 oz. 11 dwts. 6 grs.
1912 lbs. 18 dwts. 8 grs.
452 lbs. 4 oz. 11 dwts.
Accounts...........£19585„ 4„7
Bills .... 39230„16„3
Notes .... 38578„ 0„6

Avoirdupois Weight. P. 20.

230 lbs. 7 oz. 10 drs.
152 stones, 2 lbs.
1117 Cwt. 3 qrs. 10 lbs.
536 tons, 1 cwt. 1 qr.
329 casks, 449 cwt. 19 lbs.
Amount of sales...£17346„3„2

Cloth Measure. P. 21.

699 yds. 2 qrs. 3 nails.
1118 ells, 2 qrs. 2 nails, 0½ in.
514 yds. 2 qrs. 3 nails.

Long Measure P. 22.

441 mi. 4 fur. 11 po. 3¼ yds.
2376 mi. 7 fur. 78 yds. 4 in.
773 lea. 1 mi. 6 fur.

Land Measure.

415 acres, 1 ro. 10 per.
1476 acres, 3 ro. 32 per. 10 yds.
713 acres, 3 ro. 37 per.

Wine Measure.

388 gals. 2 qts. 1 pint.
263 hhds. 17 gals. 2 pints.
611 tuns, 1 hhd. 19 gals.

Beer Measure. P. 23.

231 gals. 1 qt. 1 pint.
1035 bar. 2 fir. 2 gals. 5 pints.
724 hhds. 21 gals. 3 quarts.

Corn Measure.

781 qrs. 1 bush.
501 lasts, 3 bush. 2 pecks.
677 loads, 4 qrs.

Measure of Time.

1248 years, 94 days.
700 days, 30 min. 37 seconds.
98 mo. 1 week, 5 days.

Questions. P. 24.

1. .... £34, 0,6
2. 15,18,6
3. 19,19,6
3. .... 19, 8,4
5. 130,10,0
6. 295,10,1
7. .... 563, 3,3
8. .... 1386, 3,7
9. 505 lbs. 2 oz. 10 dwts.
10. ....£904,12,0
11. .... 25, 5,0
12. 2 oz. 18 dwts. 10 grs.
13. 16 Cwt. 0 qr. 2 lbs.
14. ....£233,16,6
15. .... 120, 0,0
16. 7 Cwt. 0 qr. 21 lbs.
17. 376 yds. 1 qr. 1 nail.
18. 7 pipes, 1 hhd. 18 gallons.
19. 202 acres, 0 ro. 3 per.
20. 28 acres, 1 ro. 25 per.
Rent............ £140,17,1
21. 190 m. 5 f. 28 p. 5 y. ½ ft.
22. ....£4251,7,2
23. 4591,5,9
24. Quarters wheat, 410.
Cost.......... £1362,18,1
Qrs. barley, 1066½.
Cost......... £1865, 6,0
Qrs. oats, 466.
Cost............£797,18,0

SUBTRACTION. P. 27.

1. 133612
2. 610964
3. 96279
4. 99271
5. 764710
6. 10386
7. 16802
8. 1234668
9. 11448769
10. 900981
11. 674139
12. 44991
13. 10002
14. 876543211
15. 987889
16. 98203
17. 7995
18. 593494
19. 290919294
20. 1102109

Questions. P. 28.

1. .... 184 days.
2. .... 90 days.
3. .... 143 days.
4. .... 602 years.
5. .... 947013 inhab.
6. 4500000
7. 10810845
8. .... £8258598
9. 13766700
10. .... £184
11. On hand, 742 gallons.
12. Deficiency, £5117016

COMP. SUBTRACTION. P. 30.

1. Bal. £76, 9,11
126,14, 3½
799, 6, 6¾
4. Rem. £256, 3, 7¾
88, 7, 9¾
580, 6, 6½
5. Bal. £130, 1, 5
9, 0, 2¼
82, 9, 9
9. Bal. £231,16, 0
88,10, 2
10. Bal. £642,14, 2
11. Rem. 29 oz. 8 dwts. 21 grs.
28 lbs. 9 oz. 2 dwts.
16 grs.
87 lbs. 10 oz. 17 dwts.
14. Rem. 103 lbs. 6 oz. 14 drs.
264 Cwt. 2 qrs. 17 lbs.
103 tons, 1 cwt. 2 qrs.
28 stones, 12 lbs.
15. Gross, 161 Cwt. 0 qr. 24 lbs.
Tare, 7 Cwt. 3 qrs. 5 lbs.
Net, 153 Cwt. 1 qr. 19 lbs.
16. Rem. 40 yds. 2 qrs. 3 nails.
924 yds. 2 qrs. 2 n. 1¾ in:
93 ells, 0 qrs. 3 nails.

19. Rem. 89 yds. 1 foot, 11 in.
1460 mi. 6 fur. 35 poles, 4 yds.
28 lea. 1 mi. 5 fur.
22. 40 acr. 3 ro. 32 per.
401 ac. 3 ro. 4 p. 27 yds.
76 acr. 1 ro. 23 per.
25. Rem. 19 hhds. 14 gals. 4 pts.
15 pi. 0 hhd. 47 gals. 3 qts.
59 tuns, 2 hhds. 35 gal.
28. 100 gals. 2 qts. 1 pint.
8 bar. 2 fir. 7 gals.
82 butts, 41 gals. 3 qts.
31. 151 qrs. 5 bus. 3 pecks.
88 la. 8 qr. 6 bus. 2 pe.
82 score, 19 ch. 19 bus.
34. 100 da. 18 ho. 51 min.
11 yrs. 11 mo. 1 w. 6 d.
907 yrs. 301 days.

Questions. P. 32.

1. .... £32.10. 2½
2. .... 0. 7. 2
3. .... 112. 5. 5
4. .... 30. 0. 0
5. .... 15.12. 0
6. .... 63. 7. 6
7. .... 225.12. 1
8. .... 0.11. 3½
9. .... 241.15. 0
10. .... £1776666.18.10½
11. .... 277851005. 2. 9¼
12. .... 1614.18. 0
13. .... 822. 7.11
14. .... 747.14. 8
15. 3 lbs. 2 oz. 12 dwts.
16. 4 Cwt. 3 qrs. 5 lbs.
17. 9 yds. 3 qrs.
18. 38 miles, 4 fur. 40 yds.
19. 447 acres, 1 rood, 25 per.
20. 1 acre, 3 ro. 23 p. 17½ yds.
21. 27 gals. 2 qts. 1 pt.
22. 24 hhds. 2 fir. 7 gals.
23. 16 butts, 2 bar. 10 gals. and 104 dozen, 2 bottles.
24. Gross, 100 Cwt. 1 qr. 21 lbs.
Net, 91 Cwt. 0 qr. 5 lbs.
25. Wheat, 14 qrs. 7 bus. 3 pe.
Barley, 8 qrs. 7 bus. 3 pe.
Oats, 18 qrs. 6 bus. 1 pe.
Beans, 21 qrs. 3 bus. 2 pe.
26. A.'s age, 62 yrs. 6½ mo.
14 yrs. 10 mo.
27. Due............ £852. 0. 0
28. Debt £369. 1. 7
29. Balance 328.15. 6
30. Stock £6230. 5. 0
Ditto 7214.19.10
Gain............ 984.14.10

MULTIPLICATION. P. 36.

1. 2596296
2. 7664344
3. 25836170
4. 40230570
5. 69135801
6. 49286744
7. 888888888
8. 17890640
9. 135802458
10. 969817152

P. 37.

1. 6288425
2. 3332969
3. 6052716
4. 16569756
5. 78617056
6. 17146895
7. 5573826
8. 49486320
9. 92021028
10. 457319154
11. 96790092
12. 425185047
13. 31703703672
14. 5223925716
15. 18832689393
16. 1909104000
17. 8771299800
18. 24404935282
19. 5923027410
20. 15215645983
21. 73353972624
22. 27931879514
23. 16989660000
24. 4114546380000
25. 341851848
657407400
823950608

28. …… 1116044500
2419742500
6696267000
8987615000
17915971000
560876558500
34. …… 23413680
54631920
85850160
3590097600
6247550280
37. …… 244600000
843380800
14284640000
99992480000

Contractions. P. 38.

I.

1. …… 67778802
82840758
135557604
169447005
203336406
6. …… 581572160
763313460
981403020
1099534865
1308537360

II.

1. …… 538362
2. …… 873552636
3. …… 16802328
4. …… 39733441
5. …… 6810775

III.

1. …… 566244
2. …… 7168302
3. …… 27404340
4. …… 188019972
5. …… 7836618314
6. …… 9276984171
7. …… 78953507784

Questions. P. 39.

1. …… 30080 men.
2. …… 56940 strokes.
3. …… 98901 dollars.
4. …… 80000 loaves.
5. …… 3932160 grains.
6. …… 13832 yards.
7. …… 2943360000 times.
8. 1st *crop*, 28782 stones.
2d *crop*, 9594 stones.
9. …… 22207500 letters.
10. …… 1358280 persons.
11. …… 511290000 grains.
12. …… 81900 fishes.
13. …… 3628800 changes.
14. …… £519168
15. …… 304200 balls.
16. …… 10130241 inhab.
17. …… 8640 seeds.
18. …… 9408 pints.
19. …… 4615372800 yards.
20. …… 6220800 hanks.

COMP. MULTIPLICATION.

Exercises. P. 40.

1. ………………… £9„ 3„ 5
2. ………………… 5„ 4„ 6
3. ………………… 10„ 3„ 11
4. ………………… 4„ 8„ 10¼
5. ………………… 5„ 11„ 0
6. ………………… 7„ 15„ 10¾
7. ………………… 5„ 3„ 4
8. ………………… 28„ 19„ 9
9. ………………… 3„ 6„ 8
10. ………………… 20„ 12„ 6
11. ………………… 67„ 3„ 0
12. ………………… 1„ 14„ 10½

¶ 13. 46 lbs. 11 oz. 8 dwts.
14. 132 Cwt. 0 qrs. 3 lbs.
15. 48 tons, 2 Cwt. 2 qrs.
16. 258 yds. 3 qrs.
17. 413 miles, 6 fur. 35 po.
18. 219 acres, 3 roods, 29 per
19. 453 gallons.
20. 176 qrs. 5 bushels.

Exercises. P. 41.

1. ………………… £8„ 15„ 0
2. ………………… 56„ 5„ 0
3. ………………… 3„ 17„ 1
4. ………………… 54„ 16„ 0
5. ………………… 13„ 1„ 6¾
6. ………………… 125„ 15„ 6
7. ………………… 88„ 1„ [illegible]

8. .... £174„ 3„ 0
9. 132„ 6„ 0
10. .... 92„16„ 0
11. .... 123„10„ 5
12. 746„ 0„ 0
13. 42 lbs. 11 oz. dwt. 16 grs.
14. 262 Cwt. 1 qr. 7 lbs.
15. 298 tons, 2 Cwt. 2 qrs.
16. 751 ells, 4 qrs.
17. 332 yds. 2 ft. 8 in.
18. 2327 acres, 2 ro. 16 per.
19. 890 bar. 2 gals. 2 qts.
20. 794 qrs. 6 bus. 2 pecks.

Exercises. P. 41.

1. .... £11„ 9„ 10¼
2. .... 7„13„ 4
3. .... 47„ 9„ 4½
4. .... 38„ 3„ 3
5. .... 650„15„ 0
6. .... 171„16„10½
7. .... 243„16„ 8
8. .... 47„15„ 2¼
9. .... 167„18„ 6½
10. .... 77„ 2„ 9
11. .... 515„16„ 3
12. .... 216„18„ 9
¶ 13. 5 oz. 0 dwt. 18 grs.
14. 733 Cwt. 0 qr. 13 lbs.
15. 134 yds. 0 ft. 2 in.
16. 287 miles, 5 fur. 21 po.
17. 85 hhds. 60 gals. 3 qts.
18. 60 qrs. 0 bus. 2 pecks.
19. 2716 da. 17 ho. 24 min.
20. 1015 weeks, 6 da. 10 hrs.

Exercises. P. 42.

1. .... £296„ 2„0
2. .... 163„ 6„3
3. .... 1748„ 5„0
4. .... 108„ 9„4½
5. .... 2242„15„5
6. .... 245„10„8
7. .... 5938„ 9„7
8. ....12270„ 4„3
¶ 9. 731 lbs. 7 oz. 17 dwts. 12 grains.
10. 4628 Cwt. 2 qrs. 23 lbs.
11. 1591 stones, 13 lbs.
12. 653 miles, 4 furlongs.

Application.

Exercises. P. 42 — 44.

1. .... £3„ 3„ 0
2. .... 6„ 7„ 6
3. .... 91„ 4„ 8
4. .... 53„ 8„ 6
5. .... 50„12„ 6
6. ....1701„ 0„ 0
7. .... 107„19„ 0
8. .... 233„12„ 6
9. .... 14„ 5„10
10. .... 538„ 2„ 6
11. .... 144„ 7„ 6
12. ....1636„ 8„ 4
13. 748 lbs. 11 oz.
14. 70 lbs. 5 oz. 16 dwts. 16 grs.
15. 552 Cwt. 3 qrs. 12 lbs.
16. 555 Cwt. 2 qrs.
17. 3 oz. 12 dwts. 20 grs.
18. 2 lbs. 2 oz. 19 dwts. 14 grs.
19. 1708 acres, 35 per.
20. 1437 yds. 2 qrs.
21. 444 yds. 4 ft. 6 in.
22. 558 square yds. 2½ ft.
23. 1 fur. 14 po. 2 yds. 2 ft.
24. 179 yds. 2 ft. 6 in.
25. .... £111„0„ 5
26. 5198 stones, 2 lbs.
27. 650 miles, 5 fur. 15 po.
28. 239999 pence.
29. 1032307 halfpence.
30. 1792735 farthings.
31. 49399 sixpences.
32. 6563 fourpences.
33. 43251 threepences.
34. 25519 twopences.
35. 55907 grains.
36. 37595 dwts.
37. 10959 drams.
38. 4104 lbs.
39. 1595 quarters.
40. 1086 nails.
41. 6669 inches.
42. 867652½ yards.
43. 591320 perches.
44. 8133559½ yards.
45. 9487 pints.
46. 3921 gallons
47. 31306 quarts.

48. 59196 pecks.
49. 36077 bushels.
50. 1109016 hours.
51. 31556929 seconds.

Questions. P. 45.

1. 11742 bottles.
2. 19620 bottles.
3. .... £9922„10„ 0
4. .... 122850„ 0„ 0
5. .... 45„10„ 0
6. .... 333„ 6„ 8
7. .... 195„ 0„ 0
8. .... 108„15„ 0
9. .... 142„ 3„ 6
10. .... 9„11„ 7½
11. .... 52„10„ 0
12. 11394 bottles.
13. .... 541„ 8„ 1½
14. .... 19440„ 0„ 0
15. .... 90„16„ 8
16. 2096640 drams.
17. .... 46„ 7„ 6
18. 1128 yds. 2 nails.
19. 9 Cwt. 1 qr. 14 lbs.
20. .... £40000„ 0„ 0
21. .... 24441„ 6„ 8
22. .... 297„18„ 8
23. .... 35478000„ 0„ 0
24. Rum......... 235„12„ 3
Sugar......... 248„ 4„ 1½
Amount ..... 483„16„ 4½
25. In debt...... 23„ 0„ 0
Spent......... 216„10„ 0
26. 454975488000 herrings.
27. 3240000 fishes.
42120000 lbs. weight.
28. 44064 pecks.
440640 lbs. weight.
29. 210 quarters.
£341„ 5„ 0
708 Cwt. 3 qrs.
30. 223 Cwt. 24 lbs. lead.
55 Cwt. 3 qrs. 6 lbs. powder.

DIVISION.

Exercises. P. 47.

1. ... 4216282
2. ... 326848—2 *rem.* or ⅔.
3. ... 418312
4. ... 997217—4
5. ... 1218114—3
6. ... 1763668—2
7. ... 12345679
8. ... 98765432
9. ... 6460493—7
10. ... 123456789

Exercises. P. 48.

1. ... 47341
2. ... 109534—8 *rem.*
3. ... 22746
4. ... 350491—9
5. ... 20346—11
6. ... 27103—38
7. ... 16232
8. ... 20162
9. ... 10042—60
10. ... 30054—67
11. ... 94567
12. ... 7126—45
13. ... 5655—228
14. ... 10236—6
15. ... 11010—625
16. ... 53769—610
17. ... 10322—2340
18. ... 3581—1717
19. ... 490—51790
20. ... 2573—840
21. ... 294760
22. ... 2446—3173
23. ... 707594—770
24. ... 630203
25. ... 28710881—7
18903352—10
14190435—45
10037137—39
7913896—114
29. ... 4636874—159
2705902—91
818884—309
1286008—177
1000662—927
34. ... 737982—8
368991—8
245994—8
184495—154
38. ... 360018
300015

257155—365
225011—146
200010

Exercises. P. 49.

1. .... 3255—5 *rem.* or $\frac{5}{9}$
2. .... 2147—11
3. .... 468—16
4. .... 6001—23
5. 5040
6. .... 7083—15

Exercises. Ibid.

1. .... 36213$\frac{1}{3}$
2. 19344
3. .... 39322$\frac{1}{2}$
4. 223630
5. .... 55833$\frac{1}{3}$
6. ...... 522810$\frac{3}{4}$

Contractions.

I. P. 50.

By 25 .... 29205851—$\frac{17}{25}$
35 .... 20861322—$\frac{22}{35}$
42 .... 17384435—$\frac{22}{42}$
54 .... 13521227—$\frac{34}{54}$
63 .... 11589623—$\frac{43}{63}$
72 .... 5075534—$\frac{63}{72}$
81 .... 4511586—$\frac{45}{81}$
96 .... 3806651—$\frac{15}{96}$
121 .... 3020152—$\frac{119}{121}$
132 .... 2768473—$\frac{75}{132}$

II. Ibid.

1. .... 503$\frac{178}{310}$
2. .... 783$\frac{696}{800}$
3. .... 1378$\frac{680}{1100}$
4. .... 1026$\frac{3415}{7300}$
5. .... 236$\frac{70}{81}$

III. Ibid.

1. .... 680$\frac{83}{99}$
2. .... 23$\frac{778}{999}$
3. .... 6755$\frac{133}{999}$
4. .... 527$\frac{8903}{9999}$

Questions. P. 51.

1. .... 10101$\frac{1}{99}$
2. 8000
3. .... 112 bottles.
4. .... 4000 chests.
5. .... 137$\frac{1}{2}$ gallons.
6. .... 87$\frac{1}{2}$ miles.
7. ℘ bale ... 1792 yards.
℘ piece ... 80 yards.
8. .... 16 shirts.
9. .... 168 bottles.
10. .... 36 feet.
11. .... 15 feet.
12. 6 days, 14 hours.
13. 173 days, 3 hrs. 20 min.
14. .... Persons 10294—12 *rem.*
15. ...... 177—$\frac{20728}{57231}$
16. ...... 21 days.
17. ...... 2 stones, 8 lbs.
18. ...... 65 persons nearly.
19. ...... 33600 men.
20. ...... 1415$\frac{1}{2}$ nearly.

COMPOUND DIVISION.

Exercises. P. 52.

1. .... £48″ 8″ 9
2. .... 238″ 8″ 10$\frac{3}{4}$
3. .... 8″ 2″ 8
4. .... 1″ 8″ 4
5. .... 11″ 3″ 4
6. .... 0″ 14″ 8$\frac{1}{2}$—8
7. .... 21″ 3″ 9$\frac{3}{4}$—1
8. .... 9″ 12″ 1$\frac{1}{4}$—1
9. .... 11″ 14″ 2$\frac{1}{4}$
10. .... 87″ 18″ 1$\frac{1}{2}$
11. .... 6″ 2″ 3$\frac{3}{4}$
12. .... 2″ 5″ 0$\frac{3}{4}$—2
13. .... 6″ 8″ 9$\frac{3}{4}$—20
14. .... 1″ 11″ 6
15. .... 10″ 14″ 3
16. .... 0″ 3″ 9$\frac{3}{4}$
17. .... 0″ 18″ 9$\frac{3}{4}$
18. .... 0″ 11″ 4$\frac{1}{2}$
19. .... 0″ 8″ 11$\frac{3}{4}$
20. .... 8″ 15″ 1
21. .... £17″ 18″ 7$\frac{1}{2}$
13″ 18″ 11$\frac{1}{4}$—3
10″ 9″ 2$\frac{1}{2}$
24. .... £123″ 2″ 0$\frac{1}{2}$—6
84″ 4″ 6$\frac{1}{2}$—18
61″ 11″ 0$\frac{1}{4}$—6
9″ 8″ 3$\frac{1}{4}$—30

28. ………… £52″16″ 6¾
26″ 8″ 3¼—28
13″ 0″ 6¼—15
6″12″ 0¾—64
¶32. 13 lbs. 9 oz. 16 dwts. 21 grs.
33. 2 lbs. 8 oz. 8 drams—8
34. 7 stones, 9 lbs. 7 oz.—26
35. 13 Cwt. 2 qrs. 22 lbs.—58
36. 37 yds. 2 ft. 11 in.
37. 17 acres, 1 rood, 20 per.
38. 32 miles, 2 fur. 24 po.—78
39. 4 years, 12 days.
40. 114 Cwt. 2 qrs. 8 lbs.—10
38 Cwt. 1 qr. 23 lbs.—19
25 Cwt. 0 qr. 23 lbs.—12
16 Cwt. 3 qrs. 6 lbs.—12
44. 125 yds. 0 qr. 1¾ nails.
71 yds. 1 qr. 3 nails—12
50 yds. 0 qr. 0 nails—14
26 yds. 1 qr. 2 nails—16
6 yds. 2 qrs. 2 nails—114
49. 19 qrs. 2 bus. 1 peck—4
6 qrs. 2 bus. 2 pecks.
2 qrs. 7 bus. 0 peck—33
1 qr. 0 bus. 1 peck—70
53. 29 yrs. 260 da. 4½ hrs.
4 yrs. 89 da. 7½ hrs.
2 yrs. 44 da. 15 hrs.—42
1 year, 22 da. 7 hrs.—98

Exercises. P. 53.

1. …… 51 times or shares.
2. …… 25
3. …… 379
4. …… 42
5. …… 21 $\frac{570}{2059}$
6. …… 96
7. …… 48
8. …… 47
9. …… 100½ times.
10. …… 254
11. …… 28 times.
12. …… 56

Application.

Exercises. P. 53—55.

1. 11/8 each.
2. 36 persons.
3. ………….. £333″ 6″ 8
4. 8 lbs. 12 oz.
5. 32 parcels.
6. 1/1½ ⅌ yard.
7. 1 Cwt. 1 qr. 8 lbs.
8. 28 yds. 3 qrs.
9. 37 chests.
10. 240 guineas.
11. 30 rods, 45 feet, ⅌ week.
6 rods, 9 feet, ⅌ man.
12. 20 reapers.
13. 105 lbs. ⅌ man.
21 lbs. ⅌ month.
5 lbs. 4 oz. ⅌ week.
12 ounces ⅌ day.
14. 78 weeks.
15. ……£20″18″ 2¾ ⅌ month.
13/9 ⅌ day.
16. 8 years.
17. ………………£4721″12″ 8¼
18. ……………… 1095″11″ 4½
19. ……………… 7037″10″ 0
20. ……………… 26387″17″ 8
21. ……………… 1234″10″ 0
22. ……………… 2101″10″ 0
23. ……………… 1358″ 2″ 6
24. ……………… 909″ 1″ 0
25. ……………… 10114″ 7″ 6
26. 44½ guineas.
27. 9 lbs. 8 oz. 15 dwts. 10 grs.
28. 187 lbs. 6 oz.
29. 97 lbs. 8 oz.
30. 8260 lbs.
31. 3485 stones.
32. 1972 Cwt. 2 qrs.
33. 331 yds. 2 nails.
34. 1355 yds. 3 qrs.
35. 63568 yds. 1 ft. 6 in. 2 b. c.
36. 910 poles, 5 yds.
37. 25 fur. 185 yds. 1 ft.
38. 35 miles 5 fur.
39. 7 acres 2 ro. 9 po. 17¾ yds.
40. 4110 leagues, 1 mi. 2 fur.
41. 201 acres, 36 perches.
42. 2670 $\frac{320}{1109}$ wine gallons.
43. 11202 wine gallons.
44. 900 hhds. 40 gallons.
225 tuns, 40 gallons.
45. 3969 $\frac{463}{1103}$ ale gallons.
46. 342 bar. 33 gals. 5 pints.
47. 416 $\frac{1812}{2150}$ bushels.

48. 4276 qrs. 2 bushels.
49. 140160 hours.
5840 days.
50. 394405 days, 20 hours.
1080 yrs. 205 da. 20 hrs.

Exercises. P. 55—57.

1. 9d. ⅌ lb.
2. 4/6 ⅌ lb.
3. 5/3 ⅌ stone.
4. 6$\frac{1}{2}$d. ⅌ lb.
5. 3/11$\frac{1}{2}$ ⅌ bottle.
6. 7/6 ⅌ dozen.
7. 1/3 ⅌ quart.
8. 24 weeks.
9. .... £1„10„ 9—12
10. 1523$\frac{51}{83}$ lbs.
11. 1/0$\frac{3}{4}$ ⅌ lb.—48
12. ....£1875„ 0„ 0
13. 48 lbs.
14. 3/6 ⅌ bottle.
15. 288 bottles.
16. 6 pieces.
17. 5 dwts. 9 grs.—39
18. 1$\frac{3}{4}$d. ⅌ grain—4536
19. ... £70„11„ 0$\frac{1}{4}$ ⅌ da.—23
20. ...... 2„ 8„11$\frac{3}{4}$—169
21. 14/0 each.
22. ...£69„16„ 6
23. 4 qrs. 5 bu. 2 pks. ⅌ acre.
34 per. 4 yds. $\frac{1}{80}$ ⅌ qr.
24. £112328„15„ 4—40
78„ 0„1$\frac{1}{4}$ ⅌ min.—4440
25. Elder ....£1788„ 2„6
Younger......... 1197„ 7„6
26. .... 25„12„2
27. 48 yds. and 17/7$\frac{1}{4}$ ⅌ yd.
28. 13 cwt. 2 qrs. 16 lbs.—266
£52„14„6—34
3„17„3—1263
29. 17/10$\frac{1}{2}$—78
30. Son ...... £840„ 0„0
Mother... 280„ 0„0
Daughter 140„ 0„0

REDUCTION.

Exercises. P. 58.

1. 35460 guineas.
2. .... £9613„10„0
3. 21399 crowns.
4. 2086 $\frac{6}{21}$ or $\frac{2}{7}$.
5. .... £688„10„0
6. 6080 dollars.
7. 1458 crowns.
8. 2250 dollars.
9. 8140$\frac{1}{2}$ seven shillings.
10. 6030 half guineas.
11. 2812$\frac{1}{2}$ tokens.
12. 4860 half crowns.
13. .... £2721„18„0
14. .... 5740„10„0
15. 5250 lbs. Troy.
16. 2505$\frac{3}{5}$ lbs. Avoirdupois.
17. 3456 ells.
18. 4218$\frac{3}{4}$ yards.
19. 3384 gallons.
20. 5545 gallons.
21. 804 puncheons.
22. 2144 hhds.
23. 105 gallons.
24. 4300 bushels.
25. 6654 bushels.
26. 217 beer hhds.
¶ 27. 256 guineas.
28. 200 of each.
29. 12 dwt. 20$\frac{1}{2}$ grs.
30. 140 Cwt. 1 qr. 23 lbs. 9$\frac{1}{4}$ oz.
31. 432 gallons.
32. 9 shares each.
33. 960 bottles.
34. 112 bottles.
35. ....£265781„5„0

Promiscuous Exercises. P. 59.

1. A loses.............£165„12„3$\frac{1}{2}$
B .... 153„ 7„8$\frac{1}{4}$
C .... 369„19„2
D .... 257„ 4„4$\frac{1}{4}$
E .... 264„ 5„1$\frac{1}{2}$
F .... 201„12„6$\frac{1}{2}$
Deficiency .... 1412„ 1„2$\frac{1}{4}$
2. .... 91„10„9
3. 1279 lbs.—$\frac{21}{51}$
2/4$\frac{3}{4}$ ⅌ lb.—868
4. 2/6$\frac{1}{4}$ ⅌ ell—$\frac{3}{5}$
1/4$\frac{1}{2}$ ⅌ napkin.
16/6$\frac{1}{4}$ ⅌ dozen.
5. 6/8 ⅌ lb.
6. 13 yards.

7. 3 gallons.
8. 87 days, 23 hours.
9. $68\frac{2}{3}$ solid feet.
10. 7300 acres.
11. 199609 acres, 1 ro. 20 per.
12. 6 miles, 3 fur. 200 yds.
13. $30\frac{30}{571}$ seconds.
14. 2 mi. 1 fur. 66 yds. 2 ft.
15. 64 acres, 0 ro. $37\frac{7}{11}$ per.
16. 3 hours, $15\frac{5}{8}$ minutes.
17. $105\frac{3}{5}$ steps ⅌ min.
18. 3 miles, 7 fur. 180 yds.
19. 14 hrs. 57 min. 36 sec.
20. 37 min. 36 sec. past 5 o'clock
on Tuesday morning.
21. .... £3532401. 11. 3
22. .... 1633. 10. 0
23. 250 da. 21 hrs. $10\frac{4}{5}$ min.
24. Gain .... £ 2. 2. 9
25. A. £3750. 0. 0
B. 4500. 0. 0
C. 3000. 0. 0
26. Eldest £700. 0. 0
Second.......... 500. 0. 0
Youngest 400. 0. 0
27. 50 of each, and 15/. over.
28. 13 of each, and £7. 8 over.
43 cows, and 40/. over.
50 bulls.
55 heifers, and 90/. over.
70 steers.
29. Son £1600. 0. 0
Daughter...... 800. 0. 0
Step-son 400. 0. 0
Step-daughter 200. 0. 0
30. 1200 men.
31. Eldest......... £3500. 0. 0
Youngest 2500. 0. 0
Others, each... 2000. 0. 0
32. .... £2745666. 0. 0
33. .... 258. 9. 0
34. .... 1200. 0. 0
35. Widow £1977. 17. 5
Brother...... 1977. 17. 5
Sister .... $988.\ 18.\ 8\frac{1}{2}$
Eldest son... $2966.\ 16.\ 1\frac{1}{2}$
36. His majesty ... £562. 11. 6
Captain......... 516. 5. 5
1st mate 93. 15. 3
2d mate 62. 10. 2
Surgeon ... £125. 0. 4
Carpenter... 93. 15. 3
A Sailor ... $15.\ 12.\ 6\frac{1}{2}$
37. 165 shares, and 110 yds. over.
Value £18562. 10. 0
38. Capital ... £2250000. 0. 0
A share...... 90. 0. 0

A. R. P.
39. A soldier...... 9. 0. 12
Serjeant 18. 0. 24
Ensign 72. 2. 16
Lieutenant ... 108. 3. 24
Captain 181. 2. 0
Major 272. 1. 0
Colonel 453. 3. 0
Soldier......... $£6.\ 2.\ 6\frac{3}{20}$
Serjeant ...... $12.\ 5.\ 0\frac{3}{10}$
Ensign......... $49.\ 0.\ 1\frac{1}{5}$
Lieutenant ... $73.\ 10.\ 1\frac{4}{5}$
Captain 122. 10. 3
Major .... $183.\ 15.\ 4\frac{1}{2}$
Colonel .... $306.\ 5.\ 7\frac{1}{2}$

SIMPLE PROPORTION.

Exercises. P. 64—68

1. .... £2. 16. 3
2. .... 4. 6. 8
3. 24 yds. 1 qr. $\frac{1}{15}$.
4. 24 yds. 3 na. $\frac{9}{13}$.
5. .... £917. 0. 0
6. .... 257. 16. 3
7. .... 226. 4. 2
8. .... 154. 12. 6
9. .... 223. 13. 0
10. .... $119.\ 7.\ 11\frac{1}{2}$
11. .... 421. 13. 3
12. .... 1096. 6. 0
13. .... 7. 17. 6
14. .... 44. 12. 6
15. .... $256.\ 5.\ 9\frac{1}{4}$
16. 250 yards.
17. $68/2\frac{2}{23}$ ⅌ cwt.
18. .... £21. 0. 0
19. 392 horses.
20. .... $£3.\ 13.\ 0\frac{6}{25}$
21. 10 reapers.
22. $5\frac{1}{3}$ days.
23. 75 men.

24. $52\frac{1}{2}$ days.
25. $42\frac{2}{5}$ yards.
26. $149\frac{1}{8}$ yards.
27. $32\frac{2}{5}$ yards.
28. $95\frac{5}{6}$ yards.
29. 360 days.
30. $13\frac{1}{2}$ ounces.
31. .... £1843,15, 0
32. 146 days.
33. 180 days.
34. 200 yards.
35. 175 lbs.
36. 3/6 ℘ dozen.
37. .... £33,13,$0\frac{3}{4}$—$\frac{9}{13}$
38. 31500 burials.
39. .... £50,19,$5\frac{1}{4}$—$\frac{9}{11}$
40. 36 days.
41. 16 pints.
42. $16\frac{2}{3}$ gals. water.
43. 20 gallons.
44. $17\frac{7}{9}$ perches.
45. .... £171,19,0
46. $20\frac{1}{4}$ days.
47. Till 18th July, or 75 days.
48. 30 acres.
49. $19\frac{2}{7}$ reapers.
50. .... £13,10,0
51. .... 207, 2,$5\frac{1}{2}$
52. .... 3,10,$4\frac{3}{4}$—$\frac{1}{5}$
53. .... 1773, 6,8
54. 96 loaves.
55. .... £72,16,0
56. $15\frac{1}{2}$d. $\frac{2}{5}$
57. 147 cwt. 0 qr. 5 lbs.
58. $10\frac{1}{2}$ days.
59. 6 days.
60. 9 minutes.
61. 18/. ℘ yard.
62. 22/6 ℘ gallon.
63. Double by 1/$7\frac{1}{2}$ ℘ gallon.
64. B. by 1/. ℘ stone.
65. 31/$3\frac{1}{4}$—$\frac{87}{100}$
66. 3/9 ℘ yard.
180 yards.
67. 2 oz. 13 drams.
68. 9 hours.
72 miles.
69. Longer end, 19 inches.
Shorter.... $17\frac{1}{2}$ ditto.
70. 9 months.

COMPOUND PROPORTION.

Exercises. P. 70.

1. 40 squares.
2. 18 men.
3. $10\frac{1}{2}$ days.
4. $74\frac{2}{3}$ acres
5. 60 reapers.
6. 10 days.
7. .... £166,13,4
8. 195 days—$\frac{15}{28}$
9. 14 days.
10. $150\frac{25}{84}$ stones.
11. ....£7,9,4
12. 12,7,6
13. 42/. or £2,2,0.
14. $3\frac{3}{4}$ months.
15. 2250 men.
16. 15 men *additional.*
17. 75 days.
18. $37\frac{1}{8}$ horses.
19. $533\frac{1}{3}$ cubic yards.
20. 23 days.

DISTRIBUTIVE PROPORTION.

Exercises. P. 72.

1. A. ...... £665, 7,$1\frac{1}{2}$—$\frac{48}{49}$
B. .... 510, 2,$1\frac{1}{2}$—$\frac{126}{147}$
C. .... 354,17,$1\frac{1}{2}$—$\frac{125}{147}$
2. A. ... 135 acres.
B. ... 90 acres.
C. ... 45 acres.
3. A. £12, 5,0
B. 7, 7,0
C. 6, 2,6
D. 3,13,6
4. 1st vill. £165, 1,$10\frac{1}{2}$—120
2d ...... 198, 2, 3 —144
3d ...... 297, 3, $4\frac{3}{4}$—4
4th...... 339,12, $5\frac{1}{4}$—156
Each person 9/$5\frac{11}{53}$
5. A. £126, 0, 0
B. 94,10, 0
C. 63, 0, 0
Private 7, 0, 0
6. He pays 10/10.
7. Butler...£156, 3, $7\frac{1}{2}$
Coachman 97,12, $3\frac{1}{4}$
Footman.. 36, 8,10
Errand boy 9,15, $2\frac{1}{2}$
Lost with remainders $\frac{3}{4}$

8. Eldest.........£1363„12„ 8¾
2d son......... 1090„18„ 2¼
3d son......... 818„ 3„ 7¾
Eldest daugh. 681„16„ 4¼
Youngest da. 545„ 9„ 1
9. 8¾ ⅌ Cent.
A. B. ....£30„12„ 6

Practice.

Case I. — *Exercises.* P. 74.

1. ....£10„ 5„ 9
20„11„ 6
41„ 3„ 0
61„14„ 6
2. ....£73„ 0„10
109„11„ 3
146„ 1„ 8
219„ 2„ 6
3. ....£255„ 2„ 8
318„18„ 4
382„14„ 0
637„16„ 8
765„ 8„ 0
4. ....£817„17„ 6
1090„10„ 0
1308„12„ 0
1635„ 5„ 0
2181„ 0„ 0
3271„10„ 0

Case II. — *Exercises.* P. 75.

1. ....£349„ 7„ 1
489„13„ 7
629„11„ 9
699„10„10
769„ 9„11
2. ....£689„ 8„ 0
1608„12„ 0
1838„ 8„ 0
2068„ 4„ 0
2527„16„ 0
2757„12„ 0
2987„ 8„ 0
3. ....£2252„12„ 0
2413„10„ 0
2574„ 8„ 0
2735„ 6„ 0
2896„ 4„ 0
3057„ 2„ 0
4. ....£5956„13„ 0
6240„ 6„ 0
6523„19„ 0
6807„12„ 0
7091„ 5„ 0
7374„18„ 0
5. ....£3165„15„ 0
3283„ 0„ 0
3517„10„ 0
4103„15„ 0
5041„15„ 0
6331„10„ 0
6. ....£5895„10„ 0
6893„ 4„ 0
7890„18„ 0
8888„12„ 0
9523„10„ 0
11428„ 4„ 0
11791„ 0„ 0

Case III. — *Exercises.* P. 76.

1. ....£64„ 5„11½
90„ 0„ 3¼
115„14„ 8¾
128„11„10½
141„ 9„ 0¾
167„ 3„ 5¼
2. ....£144„ 0„ 6
154„ 6„ 3
174„17„ 9
185„ 3„ 6
195„ 9„ 3
216„ 0„ 9
3. ....£200„17„ 3½
209„19„10¾
228„ 5„ 1¼
237„ 7„ 8½
246„10„ 3¾
264„15„ 6¼
4. ....£239„ 3„ 9
247„ 3„ 2½
263„ 2„ 1½
271„ 1„ 7
279„ 1„ 0½
294„19„11½
5. ....£258„19„10½
265„16„ 2¼
279„ 8„ 9½
286„ 5„ 1½

£293, 1, 5¼
306,14, 0¾
6. ....£260, 5, 8
265,18,10
277, 5, 2
282,18, 4
288,11, 6
299,17,10
7. ....£243, 1, 1½
247,11, 1¾
256, 41,2¼
261, 1, 2½
265,11, 2¾
274,11, 3¼
8. ....£207,17,10½
214,12, 0
261,10,10½
281,13, 3
301,15, 7½
335, 6, 3
9. ....£237, 5, 3
254,16, 9
296,11, 6¾
342,14, 3
386,13, 0
474,10, 6
10. ....£529,19, 2
575, 7, 8
715, 8,10½
794,18, 9
847,18, 8
984, 4, 2
11 ....£962,10, 0
1031, 5, 0
1100, 0, 0
1210, 0, 0
1306, 5, 0
1375, 0, 0
12. ....£1057, 0, 0
1107, 6, 8
1167,14, 8
1177,16, 0
1187,17, 4
1192,18, 0
13. ....£2159,13, 6
2282,11, 8
2370, 7, 6
2458, 3, 4
2721,10,10
2809, 6, 8

14. ....£1544, 2, 6
1590,18, 4
1670, 9, 3
1768,14, 6
1871,13, 4
2105,12, 6
15. ....£2187,10, 0
2231, 5, 0
2975, 0, 0
3543,15, 0
4134, 7, 6
4580,12, 6
16. ....£4339, 7, 6
4393,15, 0
4433, 6, 8
4591,13, 4
5145,16, 8

Case IV. — *Exercises.* P. 77.

1. ....£60,16, 8
85, 3, 4
133,16, 8
158, 3, 4
206,16, 8
2. ....£208, 6, 9½
235,15, 0¾
290,11, 7
300, 3, 5¾
341, 5,10
3. ....£265, 1, 0
293,11, 0
298, 6, 0
328,14, 0
4. ....£280,11, 3½
304,11, 4¾
307, 3,11
327, 9, 0½
5. ....£160, 2, 7¾
285,10,10½
336, 6, 7¼
429,12, 2¾

Case V. — *Exercises.* P. 78.

1. ....£90, 9,11½
131,12, 8
189, 4, 5½
230, 7, 2
2. ....£230, 1, 7½
284,17, 3

£339„12„10½
387„ 2„ 5
3. ....£354„ 3„ 2½
402„ 0„ 4½
449„17„ 6¾
494„10„11¼
4. ....£420„16„ 8½
436„ 2„ 9¼
474„ 7„11¼
515„ 4„ 1¼
5. ....£485„ 5„ 7½
515„ 0„ 9½
526„ 9„ 8¼
567„13„ 9
6. ....£457„10„ 9¼
480„17„ 3½
509„11„ 5½
527„10„ 3¾
7. ....£416„11„ 6
438„10„ 0
457„13„ 8¼
464„10„ 8½
8. ....£724„ 1„ 7
740„ 5„ 2½
758„ 9„ 3¼
792„16„11¼
9. ....£370„10„11¼
375„ 2„ 5
390„13„ 6
400„14„ 9½
10. ....£672„ 4„ 1¾
691„15„ 1½
708„ 5„11¾
736„17„ 5
11. ....£896„14„10¾
914„13„ 7
932„12„ 3½
952„ 6„10¼
12. ....£539„16„ 7¼
549„12„11
637„18„ 6
657„12„ 2¾

Case VI. — *Exercises.* P. 80.

1. ....£10„15„ 5¾
14„ 7„ 3½
22„ 0„ 2
2. ....£43„ 9„ 2
48„17„ 9¾
60„10„ 7½
3. ....£94„ 5„ 9¼
97„15„ 7½
104„15„ 3¾
4. ....£152„12„11¼
154„ 5„ 9¼
156„11„ 8¾
5. ....£192„ 0„ 0
198„ 1„11
200„ 0„ 0
6. ....£338„ 1„10¼
345„15„ 6¼
358„11„ 8
7. ....£414„ 2„ 9¾
421„ 8„ 1½
425„ 0„ 9½
8. ....£975„11„ 3
982„ 3„ 6½
1041„14„ 0¾
9. ....£1159„12„ 3
1671„ 4„ 1½
10. ....£5756„13„11½
8970„ 9„ 8¼
11. ....£33„10„ 4¼
40„12„ 6½
447„ 7„ 6½
511„18„ 2¼
534„15„ 3
12. ....£301„14„10
402„ 6„ 5½
631„ 6„ 9
719„10„ 9½
13. ....£250„ 2„ 7
283„17„ 6¼
297„15„ 5¾
327„11„ 0
☞ 357„ 6„ 6¾

DEDUCTIONS ON WEIGHTS.

Case I. — *Exercises.* P. 86.

1. 18 Cwt. 3 qrs. 1 lb.
2. 21 Cwt. 2 qrs. 27 lbs.
3. 17 Cwt. 2 qrs. 15¾ lbs.
4. 19 Cwt. 0 qr. 21¾ lbs.

☞ The *Answers* to the PRACTICAL ABBREVIATIONS are omitted as an exercise for the pupil, to prove them by the foregoing Rules.

5. 29 Cwt. 0 qr. 10$\frac{1}{2}$ lbs.
6. 20 Cwt. 3 qrs. 17 lbs.
7. 23 Cwt. 2 qrs. 7 lbs.
8. 24 Cwt. 3 qrs. 1 lb.
9. 26 Cwt. 1 qr. 15 lbs.
10. ....£124. 17. 6
11. 170 Cwt. 3 qrs. 20 lbs. *net.*
................£598. 5. 0
12. 230 Cwt. 3 qrs. 5 lbs. *net.*
................£2908. 0. 3
13. .... 625. 16. 3
14. .... 329. 0. 0
15. 77 Cwt. 3 qrs. 26 lbs. *net.*
................£327. 10. 6
16. 290 Cwt. 1 qr. 14 lbs. *net.*
................£631. 11. 3$\frac{3}{4}$

Case II. — *Exercises.* P. 86, 87.

1. 27 Cwt. 2 qrs. 6$\frac{1}{2}$ lbs.
................£202. 11. 0$\frac{1}{4}$
2. 1580 lbs. *net.*
3. ....£374. 1. 10
4. 22 Cwt. 1 qr. 6 lbs.
5. ....£39. 4. 10$\frac{1}{2}$

REDUCTION OF FRACTIONS.

Case I. P. 88.

1. ... $\frac{17}{3}$; $\frac{31}{4}$; $\frac{17}{2}$
2. ... $\frac{34}{5}$; $\frac{59}{6}$; $\frac{103}{8}$
3. ... $\frac{209}{12}$; $\frac{303}{14}$; $\frac{2127}{16}$

Case II. P. 88.

1. ... 5$\frac{2}{3}$; 7$\frac{3}{5}$; 8$\frac{1}{2}$
2. ... 13$\frac{4}{7}$; 19 ; 21$\frac{8}{11}$
3. ... 28$\frac{5}{8}$; 35 ; 97$\frac{11}{12}$

Case III. P. 89.

1. ... $\frac{5}{12}$; $\frac{8}{23}$; $\frac{17}{45}$; $\frac{290}{481}$
2. ... $\frac{28}{40}$; $\frac{3}{108}$; $\frac{155}{216}$; $\frac{5}{8}$

Case IV. P. 90.

1. ... $\frac{12}{18}$; $\frac{15}{18}$; $\frac{14}{18}$
2. ... $\frac{15}{20}$; $\frac{8}{20}$; $\frac{18}{20}$
3. ... $\frac{45}{72}$; $\frac{64}{72}$; $\frac{30}{72}$
4. ... $\frac{12}{28}$; $\frac{18}{28}$; $\frac{11}{28}$
5. ... $\frac{8}{18}$; $\frac{12}{18}$; $\frac{10}{18}$; $\frac{9}{18}$

Case V. P. 90.

1. ... $\frac{2}{6}$ or $\frac{1}{3}$; $\frac{15}{35}$ or $\frac{3}{7}$
2. ... $\frac{60}{120}$ or $\frac{1}{2}$
3. ... $\frac{10}{1}$ or 10
4. ... $\frac{42}{70}$ or $\frac{3}{5}$
5. ... $\frac{187}{20} \times \frac{3}{4} \times \frac{1}{20} = \frac{561}{1600}$

Case VI. P. 91.

1. ...... $\frac{5}{12}$
2. ...... $\frac{11}{240}$
3. ...... $\frac{37}{60}$
4. ...... $\frac{85}{96}$
5. ...... $\frac{1}{14}$
6. ...... $\frac{7}{1920}$
7. ...... $\frac{13}{320}$
8. ...... $\frac{11}{48}$
9. ...... $\frac{9}{14}$
10. ...... $\frac{1}{3}$
11. ...... $\frac{3}{64}$
12. ...... $\frac{1}{21}$
13. ...... $\frac{11}{48}$
14. ...... $\frac{1}{36}$
15. ...... $\frac{8}{9}$
16. ...... $\frac{5}{18}$
17. ...... $\frac{1}{48}$
18. ...... $\frac{11}{32}$
19. ...... $\frac{15}{32}$
20. ...... $\frac{391}{504}$
21. ...... $\frac{847}{9680}$
22. ...... $\frac{13}{20}$
23. ...... $\frac{1}{108}$
24. ...... $\frac{11}{18}$

Case VII. P. 92.

1. ... 5*d.*
2. ... 11*d.*
3. ... 12/4
4. ... 17/8$\frac{1}{2}$.
5. ... $\frac{6}{7}$*d.*
6. ... $\frac{7}{8}$*d.*
7. ... 9 dwts. 18 grs.
8. ... 3 oz. 10$\frac{2}{3}$ drs.
9. ... 2 qrs. 16 lbs.
10. ... 5 lbs.
11. ... 3 qrs. 21 lbs.
12. ... 12 gallons
13. ... 2$\frac{3}{4}$*d.*
14. ... 6$\frac{3}{8}$*d.*
15. ... 3 qrs. 15$\frac{5}{9}$ lbs.
16. ... 3$\frac{1}{4}$ inches
17. ... $\frac{3}{4}$ of an inch
18. ... 1 gal. 3 qts.
19. ... 3 bushels
20. ... 47 gals. 2 pints
21. ... 12 per. 15$\frac{1}{8}$ yds.
22. ... 2 ro. 24 poles
23. ... 8 yds. 2$\frac{2}{3}$ feet
24 .... 14 ho. 40 min.

ADDITION OF FRACTIONS.

Exercises. P. 93.

1. ...... $1\frac{11}{12}$
2. ...... $1\frac{25}{84}$
3. ...... $2\frac{59}{360}$
4. ...... $3\frac{27}{80}$
5. ... $1\frac{1}{840}$
6. ... $15\frac{29}{80}$
7. ... $26\frac{4}{9}$
8. ... $128\frac{169}{616}$

¶ 9. 15/10
10. 8/2$\frac{1}{2}$
11. 7 bus. 3 pe. $1\frac{2}{3}$ qts.
12. 8 qrs. 5 b. 1 p. 1 gal.
13. 56 gals. 1 qrt. 1 pt.
14. 3 feet 3 in. 8 parts.
15. 2 da. 15 hrs. 24 min.

SUBTRACTION OF FRACTIONS.

Exercises. P. 94, 95.

1. ...$\frac{2}{16}$ or $\frac{1}{8}$
2. ......$\frac{13}{30}$
3. .. ...$\frac{1}{90}$
4. ......$\frac{11}{80}$
5. ......$\frac{1}{77}$
6. ...... $\frac{11}{18}$
7. ...... $1\frac{7}{20}$
8. ...... $11\frac{17}{72}$
9. ...... $54\frac{1}{5}$
10. ...... $61\frac{7}{12}$

¶ 11. $7\frac{11}{12}$*d.*
12. 14/11$\frac{1}{3}$
13. 3 oz. 19 dwts. $9\frac{3}{5}$ grs.
14. 13 Cwt. 1 qr. 20 lbs.
15. 2 nails.

MULTIPLICATION OF FRACTIONS.

Exercises, P. 96.

1. ...... $\frac{5}{12}$
2. ...... $\frac{9}{14}$
3. ...... $\frac{7}{24}$
4. ...... $\frac{32}{63}$
5. ...... $\frac{9}{40}$
6. ...... $30\frac{5}{9}$
7. ...... $89\frac{1}{3}$
8. ...... $207\frac{1}{2}$
9. ... $502\frac{3}{4}$
10. ... $347\frac{2}{7}$
11. ... $72\frac{51}{80}$
12. ... $393\frac{1}{15}$
13. ... 15/3$\frac{3}{4}$
14. $268\frac{19}{32}$ ft.
15. 7 feet $\frac{431}{864}$

DIVISION OF FRACTIONS.

Exercises. P. 97.

1. ...... $2\frac{1}{2}$
2. ...... $1\frac{7}{10}$
3. 5
4. ...... $1\frac{47}{128}$
5. ...... $5\frac{1}{3}$
6. ...... $\frac{5}{56}$
7. ... $166\frac{5}{6}$
8. ... 154
9. ... $11\frac{23}{33}$
10. ... $11\frac{6}{19}$
11. ... $176\frac{63}{110}$
12. ... $28\frac{77}{100}$

13. $133\frac{1}{3}$ times
14. ....£3.17. $8\frac{3}{4}$—$\frac{11}{14}$
15. $427\frac{49}{107}$ stones.

Questions. P. 98.

1. A's share 9/$2\frac{3}{4}$—$\frac{1}{18}$
   B's ... 6/$1\frac{3}{4}$—$\frac{5}{18}$
   C's ... 4/$7\frac{1}{4}$—$\frac{7}{18}$
2. P ...... $\frac{9}{14}$ product
   $\frac{1}{17}$ quotient
   2/3 difference
3. .... 160 writing
   $66\frac{2}{3}$ arithmetic
   $13\frac{1}{3}$ book-keeping.
4. .... $\frac{7}{12}$ greater by $\frac{1}{48}$
   5 dwts. Troy.
   $5\frac{1}{3}$ drs. Avoirdupois.
5. ....£4266.13. 4
6. A 990. 0. 0
   B 660. 0. 0
   C 440. 0. 0
7. A's proportion is $\frac{1}{3}$
   B pays..........£900. 0. 0
   C................ 300. 0. 0
8. ....£1471.17. 6
9. 7/6 ℘ pound
10. 5/4 ℘ pound
   Recovered £3989. 6. 8
   Loss......... 10970.13. 4
11. .... 735. 0. 0
12. A ....£984. 2. $4\frac{4}{17}$
   Gain...... 142.17. 0
   B ....£875.17. $7\frac{13}{17}$
   Gain...... 126.18. 0
13. A with £1218.15. 0
   B 975. 0. 0
   C 780. 0. 0
14. A receives...£325. 0. 0
   B 162.10. 0
   C 97.10. 0
   D's proportion $\frac{24}{60}$ or $\frac{2}{5}$
15. A man......£48. 5. $0\frac{1}{4}$—$\frac{32}{41}$
   A woman 36. 3. $9\frac{1}{4}$—$\frac{19}{41}$
   A boy...... 24. 2. 6—$\frac{40}{41}$
   A girl .... 12. 1. 3—$\frac{20}{41}$
16. A's share..£450. 0. 0
   B's 337.10. 0
   C's 112.10. 0
   D's 300. 0. 0

17. Eldest ...£3623. 14. 0
2d son... 1610. 10. 8
Wife...... 402. 12. 8
Daughter 402. 12. 8
18. Eldest ... £269. 4. 0
Younger.. 100. 19. 0
Mother... 60. 11. 44
19. Offals ..... $\frac{11}{36}$ of the weight.
20. By injustice $\frac{1}{8}$th part.

REDUCTION OF DECIMALS.

Case I. — *Exercises.* P. 101.

1. $\frac{1}{5}=.2$; $\frac{2}{5}=.4$; $\frac{3}{5}=.6$; $\frac{4}{5}=.8$
$\frac{1}{4}=.25$; $\frac{1}{2}=.5$; $\frac{3}{4}=.75$
2. $\frac{1}{8}=.125$; $\frac{3}{8}=.375$; $\frac{5}{8}=.625$
$\frac{7}{8}=.875$; $\frac{1}{16}=.0625$
$\frac{3}{16}=.1875$; $\frac{5}{16}=.3125$
3. $\frac{7}{16}=.4375$; $\frac{9}{16}=.5625$
$\frac{11}{16}=.6875$; $\frac{13}{16}=.8125$
$\frac{15}{16}=.9375$; $\frac{1}{20}=.05$; $\frac{3}{20}=.15$
4. $\frac{7}{20}=.35$; $\frac{9}{20}=.45$; $\frac{11}{20}=.55$
$\frac{13}{20}=.65$; $\frac{17}{20}=.85$; $\frac{19}{20}=.95$
$\frac{37}{40}=.925$
5. $\frac{1}{3}=.\dot{3}$; $\frac{2}{3}=.\dot{6}$; $\frac{1}{6}=.1\dot{6}6$
$\frac{5}{6}=.8\dot{3}3$: $\frac{7}{12}=.58\dot{3}$; $\frac{11}{12}=.91\dot{6}$
6. $\frac{8}{15}=.5\dot{3}3$; $\frac{4}{21}=.\dot{1}9047\dot{6}$
$\frac{5}{60}=.08\dot{3}$; $\frac{2}{75}=.02\dot{6}$; $\frac{1}{99}=.\dot{0}\dot{1}$

Case II. — *Exercises.* P. 102.

1. .125*sh.*; .3125*sh.*; .375*sh.*
2. .625*sh.*; .8125*sh.*; .875*sh.*
3. .125£ .1875£ .2125£
.28125£
4. .303125£ .375£ .4375£
.4625£
5. .525£ .5875£ .6125£
.68125£
6. .74375, .775, .875, .990625
7. $.\dot{3}33$, $.41\dot{6}$, $.591\dot{6}$
$.\dot{6}66$, $.8\dot{3}3$, $.9958\dot{3}$
8. .40625 lbs. Avoirdupois.
9. .9375 cwt.
10. .76875 ton.
11. .78125 acre.
12. .646875 mile

Case III. — *Exercises.* P. 103.

1. 1$\frac{1}{2}$*d.*; 3*d.*; 7$\frac{1}{2}$*d.*; 9*d.*
2. 3/6; 19/.; 14/6; 11/9
3. 6/8; 16/8: 8/2; 13/4
4. 2 qrs. 21 lbs.; 3 qrs. 9$\frac{1}{3}$ lbs.
3 qrs. 25 lbs.; 1 qr. 21$\frac{1}{3}$ lbs.
5. 1 bus. 2 pec.; 5 bus. 1$\frac{1}{3}$ pec
6. 1 fur.; 5 f. 39 p. 3$\frac{1}{2}$ yds.
7. 3 ro. 20 p.; 3 ro. 29$\frac{1}{3}$ per.
8. 11$\frac{7}{10}$ inches; 1 ft. 9 in.

Case IV. — *Exercises.* P. 103.

1. ... $\frac{3}{8}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{7}{8}$
2. ... $\frac{4}{25}$; $\frac{17}{20}$; $\frac{199}{200}$; $\frac{15}{16}$
3. ... $\frac{1}{20}$; $\frac{19}{25}$; $\frac{1}{200}$; $\frac{16}{625}$

Case V. — *Exercises.* P. 104.

1. ... $\frac{1}{3}$; $\frac{2}{3}$; $\frac{7}{9}$
2. ... $\frac{4}{11}$; $\frac{8}{11}$; $\frac{1}{11}$; $\frac{10}{11}$
3. ... $\frac{4}{27}$; $\frac{1}{27}$; $\frac{7145}{9999}$

Case VI. — *Exercises.* P. 104.

1. ... $\frac{1}{6}$; $\frac{5}{6}$; $\frac{1}{75}$; $\frac{23}{24}$
2. ... $\frac{85}{198}$; $\frac{134}{165}$; $\frac{5}{44}$; $\frac{29}{44}$

ADDITION OF DECIMALS.

Case I. — *Exercises.* P. 107.

1. ...... 728.71
2. ...... 4168.9014
3. ...... 413.5375
4. ...... 171.
5. ...... 82.875

Case II. — *Exercises.* P. 107.

1. ...... $289.958\dot{3}$
2. ...... $325.958\dot{3}$
3. ...... $73.069\dot{4}$
4. ...... 65.828125

SUBTRACTION OF DECIMALS.

Case I. — *Exercises.* P. 108.

1. ...... 17.885
2. ...... 17.82495
3. ...... 6874.8183

4. ...... 1803.195
5. ...... 27.3125
6. ...... 18.9
7. ...... 67.46
8. ...... 99.025
9. ...... .55
10. ...... .995

Case II. — *Exercises.* P. 108.

1. ...... $19.541\dot{6}$
2. ...... $80.8458\dot{3}$
3. ...... $80.0041\dot{6}$

MULTIPLICATION OF DECIMALS.

Case I. — *Exercises.* P. 109.

1. ...... 745.8
2. ...... .217
3. ...... 480.852
4. ...... .12716
5. ...... .30527
6. ...... .109375
7. ...... 190.096
8. ...... 2.16354
9. ...... .0575
10. ...... 9.025

Case II. — *Exercises.* P. 109.

1. ...... .119
2. ...... $19.62\dot{6}$
3. ...... 17.1875
4. ...... $.070\dot{8}$
5. ..... $35416.\dot{6}66$
6. ...... $.350\dot{6}$

Case III. — *Exercises.* P. 110.

1. ...... $117.\dot{5}$
2. ...... $75.1\dot{6}\ 49382\dot{7}$
3. ...... $715.\dot{0}3\dot{7}$
4. ...... $76.8263\dot{8}$
5. ...... £$258.91\dot{6}$=18/4
6. ...... £144.015+=3$\frac{3}{4}$*d.*
7. ...... £2370.962+=19/3

☞ *Contractions are omitted.*

DIVISION OF DECIMALS.

Exercises. P. 112.

1. ... 2355.
2. ... 422100.
3. ... 250.5588+
4. ... .09315
5. ... 10000000.
6. ... 1000.
7. ... 659.05102+
8. ... 8.4
9. ... .1228+
10. ... $.981\dot{6}$

Case II. — *Exercises.* P. 112.

1. ... $100.\dot{4}44$
2. ... $7.\dot{3}33$
3. ... $3386.\dot{6}66$
4. ... $.0763\dot{8}$

Case III. *Exercises.* P. 113.

1. ... 7.59
2. ... $26.88\dot{6}$
3. ... $.56768\dot{3}$
4. ... 6392.

☞ *Contractions omitted.*

BROKERAGE.

Exercises. P. 115.

1. .... £1„ 5„ 6
1„11„10$\frac{1}{4}$
2„ 2„ 6
2„ 7„10
2. .... £1„13„ 0
2„ 1„ 3
2„15„ 0
3„ 1„10$\frac{3}{4}$

☞ The *Answers* to the Exercises, in the CONTRACTIONS in Multiplication and Division of Decimals, to be proved by the preceding *Rules* for working Decimals.

3.	£3.16.3¾
	4.15.4½
	6.7.2
	7.3.0¾
	9.10.9
4.	£12.0.9½
	24.1.6¼
	28.1.9½

COMMISSION.

Exercises. P. 116.

1.	£15.5.3
	19.1.7
	22.17.10¼
	30.10.6
2.	£21.17.9½
	24.6.5¼
	29.3.8¾
	34.1.0
3.	£72.10.11
	81.12.3¾
	90.13.8
	108.16.4¾
4.	£131.16.10¼
	137.2.4½
	147.13.3¾
	158.4.3

Questions. P. 116.

1.	£9.5.0
2.	122.1.9¾
3.	50.8.4
4.	15.12.9
5.	528.0.3
6.	1733.0.8¼
7.	367.9.0¾
8.	584.16.3¼
9.	476.11.1

INTEREST.

Case I. — *Exercises.* P. 118.

1.	£126.10.0
2.	122.6.6
3.	197.6.3
4.	332.15.3
5.	271.13.4
6.	87.16.2¼
7.	110.5.0
8.	210.0.0
9.	182.6.1¼
10.	219.4.6

☞ Interest for days.

INTEREST FOR MONTHS.

Case II. — *Exercises.* P. 119.

1. 2/11; 5/10; 8/9
2. 7/6; 11/3; 15/
3. 5/7½; 16/10½; 28/1½
4. 13/½; 19/6¾; 26/1
5. 10/10; 32/6; 65/

INTEREST FOR DAYS.

Case III. — *Exercises.* P. 120.

1.	£1.7.11¾
	1.13.7
	3.8.3¼
	5.2.11½
2.	£2.5.8¼
	3.0.11
	3.14.1½
	6.5.10¾
	7.12.3¾
3.	£6.6.0
	13.2.9¼
	19.14.2½
	26.5.7
4.	£1.19.10¾
	3.17.0½
	5.14.2½
	13.15.2
5.	£1.8.9½
	2.17.7¼
	5.15.2½
	11.10.5
6.	£2.10.5
	5.0.9½
	10.1.7¼
	12.12.0

☞ The Exercises given in the CONTRACTIONS to be proved by *the foregoing* Rules; and for this reason the *Answers* are omitted.

7.	£3„ 3„ 0
	3„13„ 6¼
	4„ 4„ 0½
	4„14„ 6½
	8„18„ 7

☞ *Contractions omitted.*

Exercises. P. 121.

1.	£2 5„11½
2.	5„15„10½
3.	25„19„ 5½
4.	69„ 7„ 9

Exercises. P. 124.

1.	£8„10„10½
2.	12„16„ 4½
3. Interest	2„10„ 7½
Balance	2199„ 7„ 0½

DISCOUNTING BILLS.

Exercises. P. 125.

1.	£1„17„11
2. Proceeds	377„14„ 3

Exercises. P. 126.

1.	£7„ 1„ 0
2.	9„ 8„ 9½
3. Proceeds	385„ 4„11
4.	196„ 4„ 4
5. A. B.'s	358„ 1„ 7¼
C. D.'s	291„18„ 3½
E. F.'s	141„ 8„ 1½

Note. P. 126.

1.	£500„ 0„ 0
2.	952„ 7„ 7$\frac{3}{7}$
3.	1000„ 0„ 0
4. Discount	30„ 0„ 0

EQUATION OF TIME.

Exercises. P. 127.

1. 8th February.
2. 8 months.
3. 5 months.
4. 7½ months, 4th May.
5. 12½ months.
6. On 10th August.
7. On 10th February.

INSURANCE.

Case I. —*Exercises.* P. 129.

1.	£8„12„ 6
2.	149„ 1„ 9
3.	89„ 0„ 7½
4.	82„14„ 9

Case II. — P. 129.

1.	£500„ 0„ 0
2.	757„ 0„ 0 *nearly.*
3.	1737„ 0„ 0

Case III. — P. 131.

1. Net	£148„10„ 0
2.	105„ 0„ 0
3.	48„12„ 0

Case IV. — P. 132.

1. 6¼ ℘ Cent.
2. Gen. aver. 4 ℘ Cent.
   Part. do. 12½ ℘ Cent.
   The underwriters pay
   £860„12„6

STOCK-JOBBING.

Case I. — P. 134.

1.	£389„ 1„ 3
2.	992„ 3„ 9
3.	918„15„ 0
4.	176„13„ 6
5. Difference	47„ 5„ 0
6.	£8„15„ 0
7.	1235„ 4„ 1¼
8.	544„ 8„ 7

Case II. — P. 134.

1.	£561„ 2„ 5¼
2.	1602„15„10

☞ The Exercises given in the CONTRACTIONS to be proved by the *foregoing Rules*; and for this reason the *Answers* are omitted.

× Query ! whether th[illegible] is

3. £1234. 11. 4¼
4. 10191. 11. 5

Case III. — P. 135.

1. £5914. 7. 0¼
2. 6508. 6. 8
3. 70. 9. 9

Case IV. — P. 136.

1. ...£4. 17. 10 ℘ Cent.
2. ... 58. 10. 8¾ or 58½
3. ... 4. 16. 11½ ℘ Cent.

Gain and Loss.

Case I. — P. 137.

1. ... 12½ ℘ Cent.
2. ... 6¼ ℘ Cent. loss.
3. ... 12½ ℘ Cent. gain.
4. ... 12½ ℘ Cent. loss.
5. ... 7½ ℘ Cent.

Case II. — P. 137.

1. ... 8/5¼ ℘ yard.
2. ... 27/6¾
3. ... 89/3 ℘ Cwt.
... 10⅝d. ℘ lb.
4. ... £728

Case III. — P. 138.

1. ... 2/8 ℘ yard.
2. ... 16/8
3. ... £67. 4. 0 ℘ pipe.
4. ... 2/11 a yard.

Case IV. — P. 139.

1. ... 44⅜ ℘ Cent.
2. ... 9⅜ ℘ Cent. gain.
3. ... $2\frac{6}{7}$ ℘ Cent. loss
4. ... 28⅓ ℘ Cent. gain, and
2⅔ ℘ Cent. gain.

Questions. P. 139.

1. ... 12½ ℘ Cent.
Extent of, £7200
2. 10½d. ℘ lb. and
94/6 ℘ Cwt.
3. 3/9 ℘ yard.
4. 28⅓ ℘ Cent.
5. 7½ ℘ Cent.

6. A. takes 20⅝ ℘ Cent.
B. ...... 17½ ℘ Cent.
C. ...... 20 ℘ Cent.
7. 19/2 ℘ yard.
8. 45/. ℘ quarter
9. 1750 lbs. weight.
$22\frac{18}{81}$ ℘ Cent.
10. 616 lbs. sold, and
$17\frac{377}{715}$ ℘ Cent. loss.

Partnership.

Case I. — P. 141.

1. £499. 19. 11
2. A.'s share ... 395. 18. 11
B. and C. each 295. 18. 11

Case II. — P. 141.

1. A. £451. 11. 4
B. 338. 13. 6
C. 169. 6. 9
2. D. £300. 0. 0
C. 900. 0. 0
B. 1200. 0. 0
A. 1500. 0. 0
3. A.'s £559. 5. 11¼
B.'s 335. 11. 6¾
4. B. pays... £178. 1. 6
C. 118. 14. 4

Case III. — P. 142.

1. A. draws......£172. 10. 0
B. 129. 7. 6
2. A.'s share £450. 0. 0
B.'s 225. 0. 0
C.'s 112. 10. 0
3. A. with........£877. 13. 2½
B. 1097. 1. 6
C. 1462. 15. 3½

Case IV. — P. 143.

1. A. draws......£225. 8. 4
B. ... 247. 18. 4
C. ... 270. 8. 4
2. A.'s share ...£2381. 5. 0
B.'s 3306. 5. 0
3. A. receives ...£406. 8. 7¼
B. 156. 1. 4¾

PROMISCUOUS QUESTIONS.

P. 144.

1. ………………£1825„ 0„ 0
2. A. ………… £707„16„ 6¾
   B. ………… 585„ 5„ 7½
   C. ………… 257„12„ 9¾
3. A.'s gain ……£77„11„ 0
   B.'s ………… 103„ 8„ 0
4. From A. ……£106„ 4„ 4½
   B. …… 159„ 6„ 6½
   C. …… 212„ 8„ 9
5. A.'s share ….£236„10„ 0
   B.'s ………… 214„ 0„ 0

BANKRUPTCY.

Case I. — P. 145.

1. 9/6 ℘ pound.
2. 11/3 ℘ pound.
   Composition, £638„14„4½
3. 6/11¾ ℘ pound.

Case II. — P. 146.

1. ……£140„ 2„ 0 @ 2/6
   168„ 2„ 4½ @ 3/.
   252„ 3„ 7 @ 4/6
2. ……£543„ 1„10½
3. …… 1130„19„ 9½
4. …… 1880„16„ 6¼ @ 2/9
   2393„15„ 7½ @ 3/6
   3134„14„ 3¼ @ 4/7

PROMISCUOUS QUESTIONS.

P. 146.

1. Debts ……£4708„ 0„ 0
   Deficiency… 1765„10„ 0
2. ……………… 8946„17„ 6
3. 12/5 ℘ pound.
4. Loss …………£966„17„ 2
5. The offer of 20/. ℘ pound is better by …£1821„12„2

EXCHANGE.

1. *Amsterdam.* — P. 149.

1. 4558 guild. 2 stiv. 8 pen.
2. 3722 guild. 4 stiv. 7 pen.
3. 6099 guild. 12 stiv.
4. ……………… £408„19„ 2¾
5. 17575 guild. 1 stiv. 9 pen.
6. British sail. by $10\frac{10}{11}$*d.*
7. 35/6⅗ ℘ £ ster.

2. *Hamburgh.* — P. 151.

1. 5198 mar. 5 shil.
2. ………………£328„ 1„ 3½
3. ……………… 1127„12„ 4¾
4. 14252 m. 14 sh. 10½ pen.
5. 1/6$\frac{6}{85}$ ster.
6. 1/4.

3. *Paris.* — P. 152.

1. 8457 francs, 9 cents.
2. ……………… £386„18„10
3. ……………… 102„12„ 9
4. ……………… 125„ 7„ 6
5. 8562 francs, 81 cents.

4. *Madrid.* — P. 153.

1. ……………… £846„19„10
2. 4629 pias. 4 r. 19$\frac{3}{7}$ m.
3. ………………£1303„ 6„ 9¼
4. ……………… 735„ 1„ 8¼

5. *Lisbon.* — P. 153.

1. ……………… £1346„ 3„ 9½
2. 5567 mil. 703 rees.
3. ……………… £821„ 5„ 0
4. Gain………… 126„ 0„ 0

6. *Leghorn.* — P. 154.

1. ………………£322„14„ 9
2. 1564 dol. 8 soldi.
3. 11421 guilders.
4. 6672 mar. 6 sh. 9 ph.

8. *Dublin.* — P. 155.

1. … £813„ 3„ 6½ Irish.
2. … 1501„ 5„ 0 British.
3. … 985„ 2„ 1½ Irish.
4. … 4615„ 7„ 8$\frac{4}{13}$ Sterling.

9. *London.* — P. 155.

1. ………………£352„13„ 9½
2. 13/8¼, or ⅔ ℘ cent. *nearly.*
3. The bill by £2„11„8½

10. *America.* — P. 155.

1. 2080 dollars.
2. £750 sterling.
3. 1750 dollars.

United States. — P. 156.

1. …………… £1106„12„ 6
2. …………… 504„ 8„ 9
3. …………… 609„12„ 9

11. *West Indies.* — P. 156.

1. …… Sterling £600„10„ 5
2. …… Currency 883„ 7„ 7¾
3. …… Sterling 1185„14„ 3$\frac{3}{7}$

SIMPLE ARBITRATION.

Exercises. P. 158.

1. 34/1$\frac{7}{17}$ ℘ £ sterling.
2. 36/1⅛ ℘ £.
3. 33/8 Flem. ℘ £ ster.
4. 54$\frac{138}{196}$*d.* or 55*d. nearly.*
5. 181 francs, 15 cents.
6. 36¼*d.* ℘ piastre.
7. 585$\frac{15}{16}$ rees.
8. 70$\frac{12}{17}$*d.* ℘ milree.

COMPOUND ARBITRATION.

Exercises. P. 160.

1. 34$\frac{2}{107}$*d.* ℘ piastre.
2. Gain by the circular exch.
   £12„ 1„ 3
3. Gain by circular exchange,
   £3„ 2„ 6¾
4. The circulating draft,
   by £7„13„ 9¾

COMPOUND INTEREST.

Case I. — *Exercises.* P. 162.

1. …………… £1621„13„11½
2. …………… 30„ 8„ 6¼
3. …………… 587„19„ 2
4. …………… 5538„ 4„ 9½

Case II. — P. 163.

1. ……………… £328„18„ 8
2. ……………… 800„ 0„ 0
3. ……………… £395„14„ 8¼
4. ……………… 7003„10„ 0¼

Case III. — P. 163.

1. 5 ℘ Cent.
2. 5 ℘ Cent.
3. 4 ℘ Cent.

Case IV. — P. 164.

1. 7 years.
2. In 17 y. and 244 d. @ 4 ℘ Ct.
   In 14 yrs. 74 da. @ 5 ℘ Cent.
   In 11 yrs. 326 da. @ 6 ℘ Cent.
3. In 17 years.

ANNUITIES.

Exercises. P. 165.

1. …………… £1006„ 4„ 7½
2. …………… 65„12„ 0½
3. 5 ℘ Cent.
4. 10 years, 327 days.
5. …………… £54914„ 5„ 7¼
6. …………… 96„ 0„ 4½
7. …………… 172„16„ 4¾
8. 28 years 4 days.
9. …………… £1484„15„11
10. 14 yrs. 74 days.
11. ……………… £41„ 7„ 5½
12. ……………… 160„ 9„ 8¼

FREEHOLDS.

Case I. — P. 169.

1. ……………… £1000„ 0„ 0
2. ……………… 3360„ 0„ 0
3. ……………… 20000„ 0„ 0

Case II. — P. 169.

1. ……£40„10„ 0 ann.
2. …… 225„ 0„ 0 rent.
3. …… 562„10„ 0 rent.

Case III. — P. 170

1. …… 4 ℘ Cent.
2. …… 6¼ ℘ Cent.
3. …… 7½ ℘ Cent.

Case IV.—P. 171.

1. 16 years.
2. 13⅓ years.
£2500.

Case V.—P. 171.

1. 6¼ ℘ Cent.
2. 4⅙ ℘ Cent.
3. 8¼ ℘ Cent.

Promiscuous Questions.

1. £90 ℘ annum.
2. 18 years.
3. £5000
4. 12½ years.

Reversions.

Exercises. —P. 173.

1. ……………… £1967„ 2„ 0¼
2. ……………… 3030„ 8„ 2
3. ……………… 3058„18„ 1½

Case II.—P. 173.

1. ………………… £593„19„7
2. ………………… 77„18„4

Miscellaneous Questions.

P. 174—180.

1. ………………… £43„15„ 7
2. ………………… 144„ 4„ 2½
3. 76/2 ℘ Cwt.
9½*d.* ℘ lb.
4. 40 sacks.
5. Gain ………… £16„16„0
28⅜ ℘ Cent., or 3¼*d.*—$\frac{23}{37}$ ℘ shilling.
6. 17/6 ℘ Ream.
7. £836„ 3„ 6
8. Second quality by £2„13„ 4
9. Best quills 2/4 ℘ 100.
Inferior 1/2 ℘ do.
10. 8 ℘ Cent.
11. 15 ℘ Cent.
12. 6/8½ ℘ lb. *nearly.*
13. Loss ……………£1„ 4„ 7
14. Gain……………… 35„ 1„ 3
15. 29/9¾ ℘ Cwt.
16. Expence, £2100
10/6 each.
17. 820⅘ yards.
18. Gain ………… £327„10„ 0
19. B. pays D. … 5„ 0„ 0
C. pays D. … 37„10„ 0
B. advances… 42„10„ 0
20. Muslin 2/9¾ ℘ yd.
Cloth 16/. ℘ yd.
21. Merchant by 7½ ℘ Cent., or 6/. ℘ Cwt.
22. 40 ℘ Cent. ℘ ann.
23. ……………… £1837„10„ 0
24. Proceeds …… 1059„10„ 4¾
25. Gain………… 99„11„ 3½
26. 4⅓ months.
27. 140 days, or on 22d January.
28. *First* bill ……£408„ 8„11
2d ……………… 415„ 3„ 9
3d ……………… 421„14„ 2
29. 61 days, or 7th May.
30. According to C.'s *proposal.*
1st bill………£253„ 2„ 6
2d bill ……… 256„ 5„ 0
3d bill ……… 259„ 7„ 6
4th bill……… 262„10„ 0
According to D.'s *wish.*
1st bill………£253„ 3„ 3
2d bill ……… 256„ 8„ 2
3d bill ……… 259„14„10
4th bill……… 263„ 3„ 2
31. 24640 cubic yards.
Amount £1540.
32. 57$\frac{13}{84}$ gallons.
33. 4th June @ 87 days' date.
34. Bill for £247„17„11
35. 11 months, 10 days.
36. A *Note* @ 127 days.
37. Balance £27„16
38. Profits £1350
39. Rum at 17/9¾ ℘ gallon.
40. Gain…………£208„16„ 8
41. 76/9 ℘ quarter
42. Gain ……£18„11„ 8
22½ ℘ Cent. *nearly.*
43. 60 yards.
20/. prime cost.
30/. selling price.
44. 108 yards.
21/. ℘ yard.
45. ……………………£6„10„ 0

13. Cubic ft. 200..7½ inches.
14. ... £2..19..6 ℘ square.
... 5/4⁴⁄₇ ℘ yard.
15. Squares 19, 76¼ feet.
Price...£64..4..6¾
16. 7964 slates.
Expenses, £27..17..6
17. Squares 15, 39 ft.
£32..6..7
18. .... 2137½ tiles.
£8..0..4
19. ...... 146 yds. 7..10½
Expenses...£4..5..8
20. .... 3..6..0
21. .... 3..8..9½
22. .... 1..7..2⅔
23. ... 3168 square feet.
24. ... 378 superficial feet.
25. Carpenter £25..13..4
Plumber... 40..18..1½
26. 230 deals.
Expense, £101..8..7
27. 217 yds. of paper.
Expense, £9..9..10½
28. 40½ feet.

SQUARE ROOT.

Exercises. P. 213.

1. ... 78.
2. ... 603.
3. ... 1292.
4. ... 441.
5. ... 14264.
6. ... 207008.
7. ... 1111.
8. ... 234.5
9. ... .01809
10. ... 36.333
11. ... .666
12. ... ¹³⁄₁₄; ¹⁷⁄₁₉

APPLICATION.

P. 213.

1. ... 6
2. ... 13.856+
3. ... 56 lbs.
4. ... 24⅓ inches shorter end.
31⅔ *in.* long end.+
5. ... 16.5 feet.
6. ... 208.713+feet.
7. ... 21.9+perches.
8. ... 55½ perches *nearly*.
9. ... 14 feet 8 inches.
10. ... 20.45+inches.
11. ... *same time*.
12. ... 42 yds. 1¼ feet.
13. ... 135 feet.
14. ... 202½ feet *nearly*.
15. ... 56 feet.
16. ... 21 miles, 4 fur. 110 yds.+

CUBE ROOT.

Exercises. P. 216.

1. ...... 12.
2. ...... 72.
3. ...... 345.
4. ...... 301.
5. ...... .22
6. ...... 104.5
7. ...... 3.837+
8. ...... .965+
9. ...... ¹¹⁄₁₅
10. ...... ⅞ and ⁹⁄₁₂

APPLICATION.

1. ...... 72 lbs.
2. ...... 337½ tons.
3. ...... 348⁴⁄₉ grains.
4. ...... 28 feet.
5. ...... 25 inches.
6. ...... 144 feet.
7. ...... 26 inches *nearly*.
8. ...... 104⅛ inches.
9. ...... 6.6+inches.
10. ...... 1.259+cubits.
11. Length 180.2+inches.
Breadth 92.3+inches.
Depth... 38.9+inches.
12. Length 26.9+feet.
Breadth 15.8+feet.
Depth... 12.7—feet.

END OF THE ANSWERS TO THE EXERCISES.

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